PRESS F5 TO START

This presentation contains National 5 Applications of Mathematics past paper questions complete with solutions. The solution to each question will be on the following slide.

The questions are sorted into topics based on the National 5 Applications of Mathematics course.

To access a particular question from the main grid just simply click on the question number.

To access the formula sheet press the F button.

To begin click on Main Grid.

Main Grid

Topic	Speciman		2018		2019			
	P1	P2	P1	P2	P1	P2	P1	P2
Foreign Exchange	7		7			3		
Scales/Tables	4 10b	2	4	7	4	4 7d		
Scale Drawing		7	12		8			
Percentages/ Decimals		1	8 10	1	5 6	1 6		
DST					13			
Time	1		9		9			
Tolerance	3		1		1			
Probability	2		14					
Wages and Income	6	6		8 10	2	10c		
Budgeting	11	8	2	3 10c		9d		
Ratio/Proportion	9		15	5 6	11 12	10b		
Gradient	12							
Fractions/Bodmas	8		5 6		10			
Scattergraphs	10		3			7c		
Pie Charts/Stem + Leaf	5	4		4	3	9a		
Box Packing		5		9c		9c		
Pythagoras		9	13			8		
Volume		10		11c		2		
Area/Perimeter			11	11		5 10a		
Mean/ Standard Deviation		3		8c		7ab		
Box Plots/SIQR	5			2	7			
Precedence Tables	13			9		9b		

1. Liam is on holiday in New York.

He looks at the world time app on his phone.

The display shows the times below:

His flight to Glasgow departs New York at 8:00 am local time.

The flight time is 6 hours 30 minutes.

Calculate the local time when the plane lands in Glasgow. 2

F

Main Grid

1			Ans: 7:30pm •[1] Strategy: Know how to deal with flight time and time zone •[2] Process/communication: state time	•[1] Evidence of adding flight time and time zone •[2] 7:30pm	2

F

Main Grid

2. S6 pupils were asked to choose their favourite subject.

The results are shown in the table below.

Subject	Boys	Girls
Geography	11	7
French	9	14
Maths	18	13
Spanish	10	12
Modern Studies	18	8
Total	66	54

Calculate the probability that a boy from this group chose French as his favourite subject.

Give your answer as a fraction in its simplest form. **2**

F

Main Grid

2			Ans: $\frac{3}{22}$ •[1] Identify correct values •[2] Process/communication: express as a fraction in its simplest form	•[1] Identify 9 and 66 •[2] $\frac{3}{22}$	2

F

Main Grid

3. A company orders a bag of washers with a thickness of $2{\cdot}4 \pm 0{\cdot}05$ mm.

An inspector takes a sample from the bag of washers.

The thicknesses, in mm, of the washers in this sample are shown below.

2·44, 2·37, 2·36, 2·45, 2·35

2·35, 2·44, 2·43, 2·34, 2·40

2·40, 2·41, 2·39, 2·38, 2·46

2·41, 2·39, 2·53, 2·36, 2·37

For the bag to be accepted, at least 88% of the washers in this sample must be within tolerance.

Will the bag be accepted? **3**

F

Main Grid

3			**Ans: No, supported by working** •[1] Strategy: know to use upper/lower limits •[2] Process: calculate % outwith tolerance •[3] Communication: state conclusion	•[1] Evidence of 2·35 and 2·45 (may be implied in [2]) •[2] 17/20 = 85% •[3] No, as 85% < 88%	3

F

Main Grid

4. The table below shows the vehicle tax to be paid on different vehicles.

The amount of vehicle tax paid depends on the CO_2 emissions of the vehicle and the fuel type.

		Tax for Petrol and Diesel Cars				
		Non Direct Debit		Direct Debit		
Bands	CO_2 emission figure (g/km)	12 months	Six months	Single 12 month payment	Total payable by 12 monthly instalments	Single six month payment
Band A	Up to 100	£0	–	–	–	–
Band B	101 to 110	£20	–	£20	£21	–
Band C	111 to 120	£30	–	£30	£31·50	–
Band D	121 to 130	£110	£60·50	£110	£115·50	£57·75
Band E	131 to 140	£130	£71·50	£130	£136·50	£68·25
Band F	141 to 150	£145	£79·75	£145	£152·25	£76·13
Band G	151 to 165	£180	£99	£180	£189	£94·50
Band H	166 to 175	£205	£112·75	£205	£215·25	£107·63
Band I	176 to 185	£225	£123·75	£225	£236·25	£118·13
Band J	186 to 200	£265	£145·75	£265	£278·25	£139·13
Band K	201 to 225	£290	£159·50	£290	£304·50	£152·25
Band L	226 to 255	£490	£269·50	£490	£514·50	£257·25
Band M	Over 255	£505	£277·75	£505	£530·25	£265·13

Tom buys a petrol car which has a CO_2 emission figure of 142 g/km.

Tom decides to pay his vehicle tax by direct debit in two single six month payments.

How much more expensive is this than a single 12 month payment by direct debit? 3

F

Main Grid

4			Ans: (£)7·26		3
			•[1] Strategy: pick correct band	•[1] band F (could be implied by subsequent working)	
			•[2] Communication: pick consistent values from table	•[2] 76·13 and 145	
			•[3] Process/Communication: conclusion	•[3] $2 \times 76{\cdot}13 - 145 = 7{\cdot}26$	

F

Main Grid

5. This back-to-back stem and leaf diagram represents the number of hours a class spends on social networking websites in a week.

Girls		Boys
	0	3 6 8 9
8 4 3 0	1	1 2 4 7 7 8 9
9 8 7 6 2 2 1	2	2 6 7 8 8
7 2 0	3	
2	4	

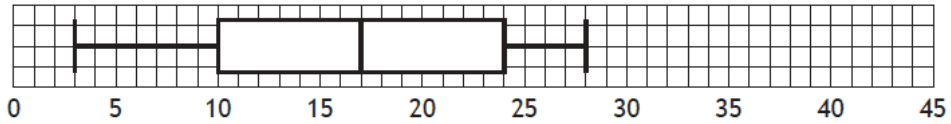
n = 15 n = 16

KEY

3 | 1 | represents 13 hours

2 | 5 represents 25 hours

(a) A boxplot is drawn to represent one set of data.



Which set of data does this represent?

Give a reason for your answer. 1

(b) For the other set of data, state:

the median

the lower quartile

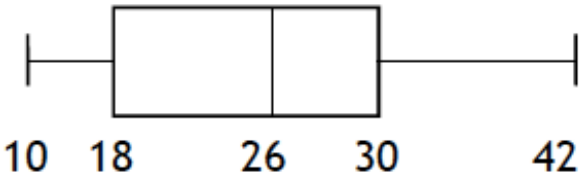
the upper quartile. 2

(c) Construct a box plot for the second set of data. 2

(An additional diagram, if required, can be found on *page 16*.)

F

Main Grid

5	(a)		Ans: boys with valid reason		1
	(b)		Ans: 26, 18, 30 •[1] Process: state the median •[2] Process: state the quartiles	•[1] 26 •[2] 18, 30	2
	(c)		Ans:  •[1] Strategy: correct end points •[2] Strategy: correct box	•[1] end points at 10 and 42 •[2] box showing Q_1, Q_2, Q_3	2

F

Main Grid

6. Mo is an electrician.

The table below shows the hours that Mo worked last week.

Monday	09:00 to 12:30	13:30 to 18:00	
Tuesday	09:00 to 12:30	13:30 to 18:00	
Wednesday	09:00 to 12:30	13:30 to 18:00	18:30 to 21:30
Thursday	09:00 to 12:30	13:30 to 18:00	18:30 to 21:30
Friday	09:00 to 12:30	13:30 to 18:00	

His basic hourly rate is £15·60.

Hours worked between 6 pm and 7 am are paid at time and a half.

Calculate his gross pay for last week. 3

F

Main Grid

6			Ans: (£)764·40		3
			$\bullet^1$ Process: calculate basic and overtime hours	$\bullet^1$ 40 and 6	
			$\bullet^2$ Process: calculate overtime	$\bullet^2$ $6 \times 1{\cdot}5 \times 15{\cdot}60 = 140{\cdot}40$	
			$\bullet^3$ Process: calculate gross weekly pay	$\bullet^3$ $15{\cdot}60 \times 40 + 140{\cdot}40 = 764{\cdot}40$	

F

Main Grid

7. Jack is going to a festival in the Czech Republic from his home in Glasgow.

His mum orders the tickets costing 1500 Czech Koruna.

His mum lives in Poland so he must pay her back in Polish Zloty.

Rates of exchange	
Pounds Sterling (£)	Other Currencies
1	30·00 Czech Koruna
1	4·96 Polish Zloty

Calculate how many Polish Zloty he must give to his mum. 2

F

Main Grid

7			Ans: 248 (Zloty)		2
			•1 Strategy: know to divide by 30 then multiply by 4·96	•1 Evidence	
			•2 Process: all calculations correct	•2 $1500 \div 30 = 50$ $50 \times 4{\cdot}96 = 248$	

F

Main Grid

8. A class of pupils were asked about how they travelled to school on a particular day.

- $\frac{1}{6}$ of the pupils were driven to school in a car.
- $\frac{2}{5}$ of the pupils took the bus.
- The rest of the pupils walked to school.

Calculate the fraction of pupils who walked to school. 3

F

Main Grid

8			Ans: $\frac{13}{30}$ •[1] Strategy: know to add fractions •[2] Process: add fractions •[3] Strategy/process: calculate fraction who walked to school	•[1] evidence •[2] $\frac{1}{6}+\frac{2}{5}=\frac{5}{30}+\frac{12}{30}=\frac{17}{30}$ •[3] $\frac{13}{30}$ or equivalent	3

F

Main Grid

9. It takes 5 bakers 3 hours to decorate a tray of cupcakes.

All the bakers work at the same rate.

Calculate the time taken for 4 bakers working at this rate to decorate the same number of cupcakes.

Give your answer in **hours and minutes.** 3

F

Main Grid

9			Ans: 3 hours 45 minutes •[1] Strategy: know how to find the time for 4 bakers •[2] Process: calculate time taken for 4 bakers •[3] Communication: state time in hours and minutes	•[1] evidence •[2] $3\times5\div4=3\cdot75$ •[3] 3 hours 45 minutes	3

F

Main Grid

10. Canoeists in Scotland use water level data to decide if there is enough water in a river to canoe down it.

The data for the River Tweed is shown below.

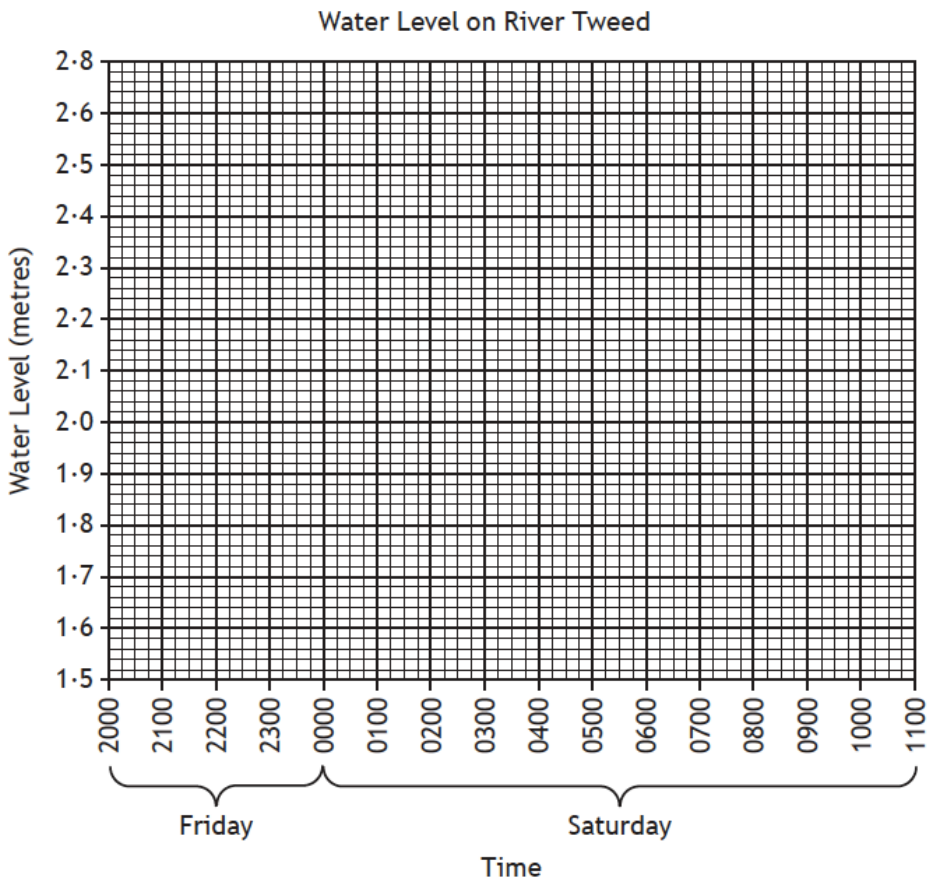


Table 1

Time	Water Level (metres)
Friday 2015	1·55
Friday 2200	1·58
Friday 2315	1·67
Saturday 0015	1·70
Saturday 0100	1·88
Saturday 0300	1·97
Saturday 0415	2·05

(a) (i) Plot the water levels on the scattergraph. **2**

(ii) Draw a line of best fit on the scattergraph. **1**

F

Main Grid

10	(a)	(i)	**Ans: Points marked** •[1] Strategy: four points plotted correctly •[2] Strategy: remaining three points plotted correctly	•[1] Evidence •[2] Evidence	**2**
		(ii)	**Ans: Acceptable line of best fit drawn** •[1] Communication: line of best fit drawn	•[1] Evidence	**1**

F

Main Grid

(b) The water level is predicted to rise at the same rate until 1100 on Saturday.

The canoeists use their line of best fit to predict the water level of the River Tweed at 0830 on Saturday.

They hope that it will be "Very High".

Table 2

River Tweed	
Water level:	
Huge	> 3·5
Very High	2·5 - 3·5
High	2·0 - 2·5
Medium	1·7 - 2·0
Low	1·2 - 1·7
Scrapeable	0·0 - 1·2
Empty	never

Will the Tweed be "Very High" at 0830?

Justify your answer. 2

F

Main Grid

(b)		**Ans: No, with justification** •[1] Strategy: extend line of best fit and read graph •[2] Communication: give reason	•[1] Evidence •[2] No, as the height will only be 2·36 metres at 0830	**2**

F

11. Mhairi bought 200 shares for £700.

She decides to sell them, but the share price has dropped to £2·75 per share.

She also has to pay a fee of 2½% of her selling price when she sells her shares.

Calculate the loss that she has made. 4

F

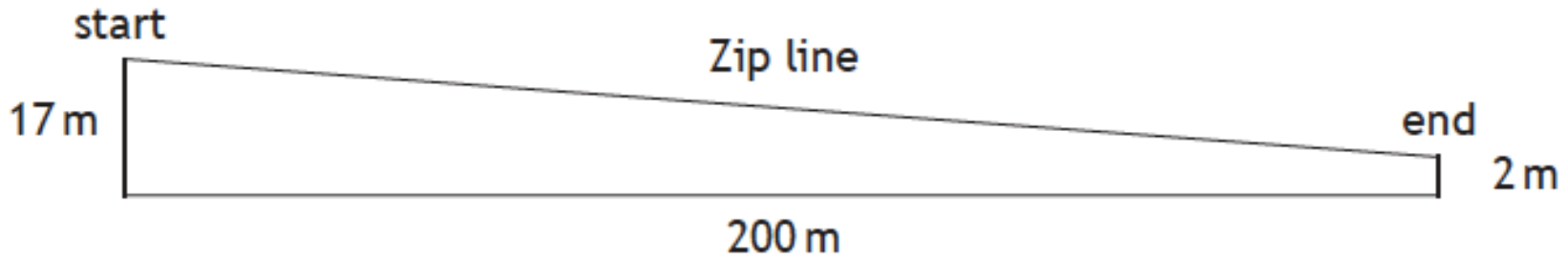
Main Grid

11			Ans: £163·75		4
			•[1] Calculate selling price of the shares	•[1] $200 \times 2{\cdot}75 = 550$	
			•[2] Calculates 2½% of selling price	•[2] £13·75	
			•[3] Calculates amount she receives	•[3] $550 - 13{\cdot}75 = 536{\cdot}25$	
			•[4] Calculates loss	•[4] $700 - 536{\cdot}25 = 163{\cdot}75$	

F

Main Grid

12. The diagram shows a planned zip line for a play park.



It is recommended that the average gradient of the zip line should be between 0·06 and 0·08 to be safe.

Does the planned zip line meet these safety recommendations?

Use your working to justify your answer. 3

F

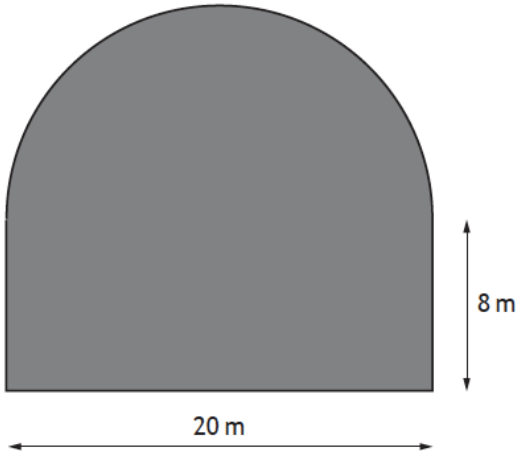
Main Grid

12			Ans: Yes, supported by working		3
			•[1] Process: calculate gradient	•[1] 15/200	
			•[2] Strategy: know how to compare gradients	•[2] 15/200 = 0·075	
			•[3] Communication: state conclusion consistent with working	•[3] yes, 0·06 < 0·075 < 0·08	

F

Main Grid

13. Joe buys a plot of land in the shape of a rectangle and a semi-circle, as shown below.



He plans to put a fence around the plot of land.

He employs Fence Direct to build the fence.

Fence Direct charges £15 per metre including all materials and labour.

(a) Calculate the cost of the fence. 3

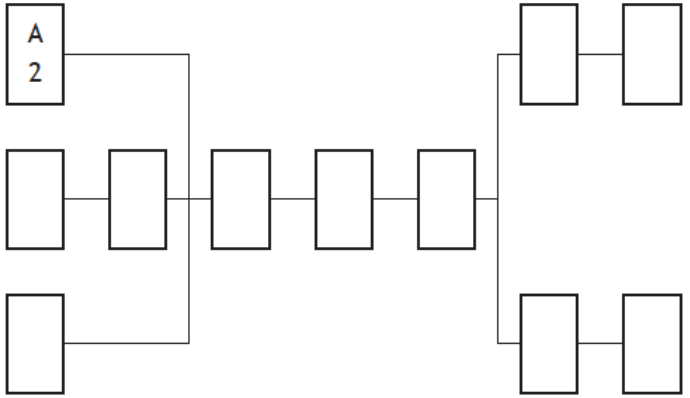
Take $\pi = 3{\cdot}14$.

(b) Fence Direct provides a team of workers to build the fence.

The table shows the list of tasks and the time taken to complete them.

Task	Detail	Preceding Task	Time (hours)
A	Take down old fence	None	2
B	Measure length of fence needed	None	0·5
C	Mark on the ground where new posts must go	None	0·5
D	Collect materials and tools from yard	B	1
E	Hammer posts into the ground	A, C, D	4
F	Attach metal fencing to posts	E	2
G	Attach barbed wire to top of posts	F	1
H	Gather up rubbish	G	2
I	Gather up tools	G	0·5
J	Take rubbish to recycling centre	H	1
K	Put tools back in yard	I	0·5

Complete the diagram below by writing these tasks and times in the boxes. 2



(c) Fence Direct claims that all of these tasks can be completed in 10 hours.

Is this a valid claim?

Use your working to justify your answer. 2

F

Main Grid

13	(a)		**Ans: (£)1011**		3
			•[1] Strategy: know to add semi-circle and 3 straight edges	•[1] Evidence	
			•[2] Process: calculate perimeter	•[2] $\frac{1}{2}\times 3{\cdot}14\times 20+20+8+8=67{\cdot}4$	
			•[3] Process: calculate cost	•[3] $67{\cdot}4\times 5\times 3 = 1011$	
	(b)		**Ans: task letters and times inserted into chart**		2
			•[1] Strategy: start to allocate tasks	•[1] Any 7 boxes correct	
			•[2] Strategy: complete allocation of tasks	•[2] Remaining 4 boxes correct	
	(c)		**Ans: no with reason**		2
			•[1] Strategy: select critical path	•[1] $2+4+2+1+2+1$	
			•[2] Communication: state conclusion with reason	•[2] No, because it will take 12 hours	

F

Main Grid

1. Mrs Abid took a survey in her mathematics class of how pupils travelled to school.

The results are shown in the table.

	Walk	Cycle	Bus
Boys	6	4	3
Girls	2	3	12

What is the probability that a pupil chosen at random is a girl who cycles to school?

Give your answer in its simplest form. 2

F

Main Grid

Ans: $\frac{1}{10}$

- [1] Strategy: know how to calculate probability

- [2] Process: correctly simplify

2

- [1] $\frac{3}{30}$

- [2] $\frac{1}{10}$

F

Main Grid

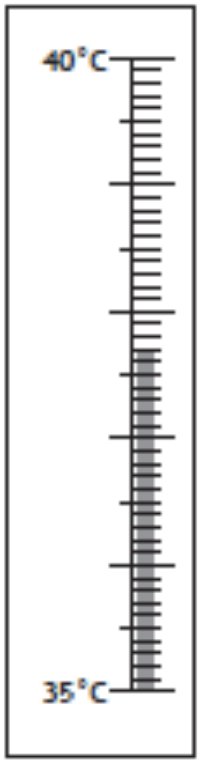
MARKS

2. Frances is not feeling well.

She takes her temperature using a thermometer.

Her temperature is shown below.

The temperature of a person in good health is 36·8°C ± 0·4°C.



Is Frances in good health?

Give a reason for your answer. 3

F

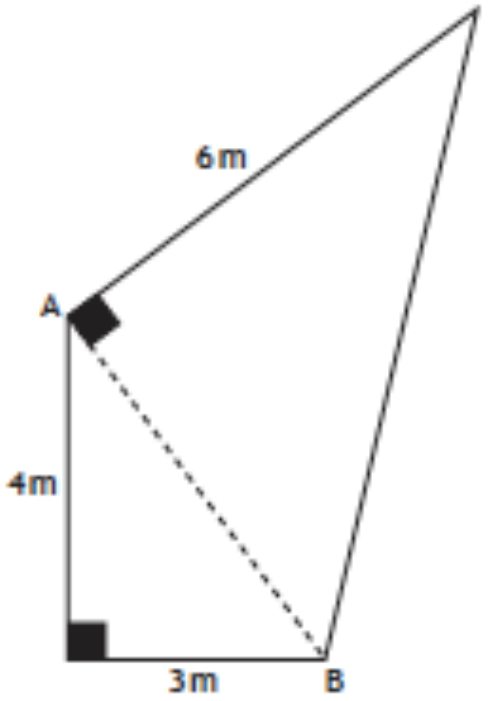
Main Grid

Ans: no with reason	**3**	
• [1] Strategy: find temperature from scale		• [1] 37·7 °C
• [2] Strategy: determine upper limit of tolerance		• [2] (36·4 °C to) 37·2 °C
• [3] Communication: state conclusion		• [3] Frances is not in good health as her temperature (37·7 °C) is above the upper tolerance (37·2 °C) of good health.

F

Main Grid

3. A new sail is being designed for a yacht as shown below.
It consists of two right angled triangles.



(a) Calculate the length of AB. 1

(b) Calculate the total area of the sail. 2

F

Main Grid

Ans: 5 (m) • [1] Strategy: Use Pythagoras to find AB.	**1**	• [1] AB = $\sqrt{3^2 + 4^2}$ = 5

Ans: 21 m^2 • [1] Strategy: know to find areas of two triangles and add • [2] Process/Communication: calculate areas and add, stating units	**2**	• [1] Evidence • [2] 6 + 15 = 21

F

Main Grid

4. Adam works for 40 hours per week as a tractor driver on a farm.

His basic wage is £7·40 per hour.

Each week he pays £28·43 Income Tax and £8·57 in National Insurance.

(a) Calculate his take home pay. 1

F

*Question Continues On Following Slide

Main Grid

(b) Adam is going on holiday in 13 weeks.

The holiday costs £320 and Adam wants to take £200 spending money.

He makes a table to show his weekly income and outgoings.

He puts the balance into his holiday fund.

	Income	Outgoings
Take home pay		
Rent		£76
Bills		£41
Food		£45
Entertainment		£30
Transport		£23
Holiday Fund		

Will he have enough to cover the cost of the holiday and his spending money?

Justify your answer. 3

F

Main Grid

4.	(a)		Ans: £259 • [1] Process: calculate take home pay in £	1	 • [1] 296 - (28·43 + 8·57) = 259
Notes:					
	(b)		Ans: yes with reason • [1] Strategy/Process: calculate holiday fund • [2] Process: find total cost of holiday and total holiday fund 13 × 44 • [3] Communication: state conclusion with reason	3	 • [1] 259 - (76 + 41 + 45 + 30 + 23) = 44 • [2] 520 and 572 • [3] Yes he can afford the holiday as he can save £52 more than he needs.

F

Main Grid

5. Reece is given a lift to school.

She leaves the house at 8:30 am and arrives at school at 8:50 am.

She uses an app on her phone to calculate her average speed for the journey.

Her phone displays 6·8m/s.

What distance did she travel?

Give your answer to 2 significant figures. **4**

F

Main Grid

5.			**Ans: 8200 metres (8·2 km)**	**4**	
			• [1] Strategy: Evidence of suitable conversion of units		• [1] 20 min x 60 (change to secs) 6.8 m/s x 60 (m per min)
			• [2] Strategy: Know how to find distance		• [2] $D = S \times t = 6{\cdot}8 \times 20 \times 60$
			• [3] Process: calculate distance correctly		• [3] D = 8160 metres
			• [4] Communication: round answer correctly, using appropriate units		• [4] D = 8200 metres or 8·2 kilometres

F

Main Grid

6. The Clarks employ Kitease to install a new kitchen for them.

Kitease provide a team of workers to install the kitchen.

The table shows the list of tasks and the time required for each.

Task	Detail	Preceding task	Time(hours)
A	Begin electrics	None	3
B	Build cupboards	None	5
C	Begin plumbing	None	2
D	Plaster walls	A,B,C	8
E	Fit wall cupboards	D	6
F	Fit floor cupboards	D	5
G	Fit worktops	F	3
H	Finish plumbing	G	3
I	Finish electrics	E,G	4

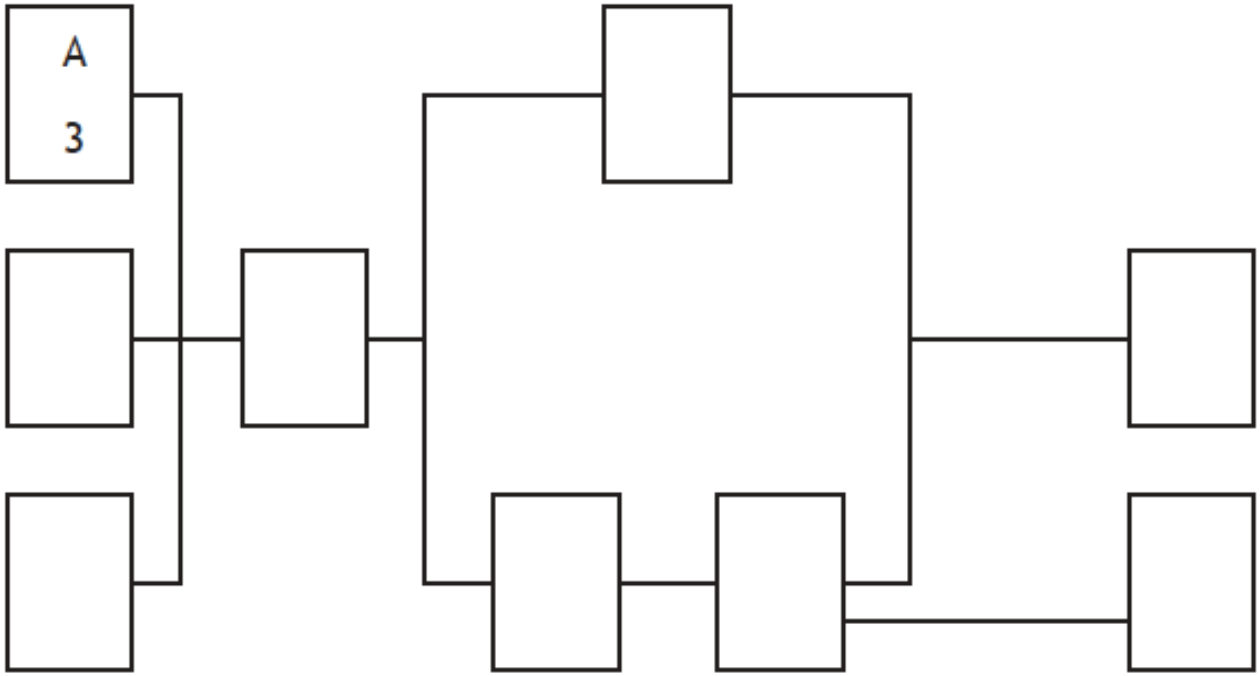
(a) Complete the diagram below by writing these tasks and times in the boxes.

(An additional diagram, if required, can be found on *Page fifteen*.)

F

*Question Continues On Following Slide

Main Grid



2

(b) Kitease claim they can install this kitchen in 22 hours.

Is this a valid claim?

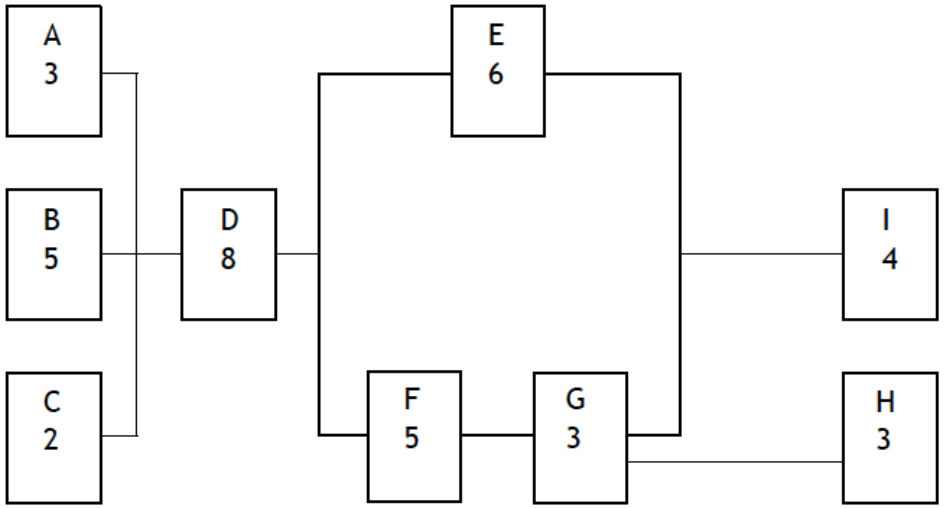
Give a reason for your answer. 2

F

Main Grid

6.	(a)		Ans: task letters and times inserted in chart • [1] Strategy: start to allocate tasks • [2] Strategy: complete allocation of tasks	2	• [1] Any 5 boxes correct • [2] Remaining 3 boxes correct

Notes:



(b)		Ans: no with reason • [1] Stratgey: select critical path • [2] Communication: state conclusion with reason	2	• [1] 5+8+(5+3)+4 • [2] no, because it will take 25 hours

F

Main Grid

7. This back-to-back stem and leaf diagram represents the number of hours a class spends on social networking websites in a week.

Girls		Boys
	0	3 6 8 9
8 4 3 0	1	1 2 4 7 7 8 9
9 8 7 6 2 2 1	2	2 6 7 8 8
7 2 0	3	
2	4	

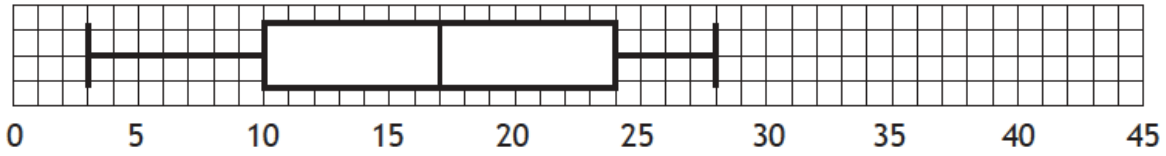
n = 15 n = 16

KEY

3 | 1 | represents 13 hours

2 | 5 represents 25 hours

(a) A boxplot is drawn to represent one set of data.



Which set of data does this represent?

Give a reason for your answer. 1

F

Main Grid

MARKS

7. (continued)

(b) For the other set of data, state:

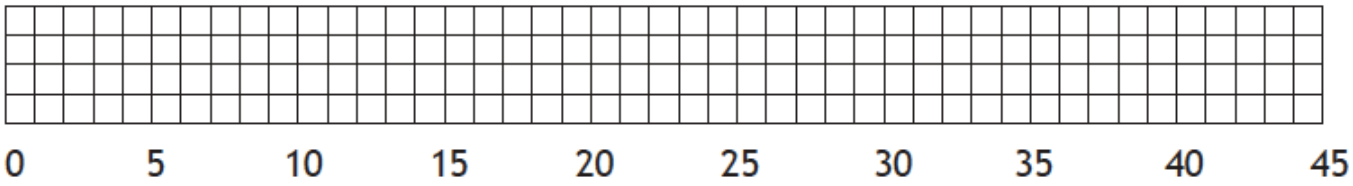
the median

the lower quartile

the upper quartile 2

(c) Construct a box plot for the second set of data.

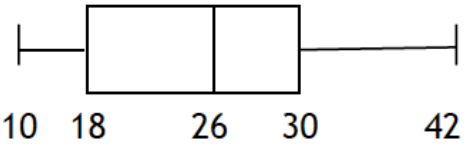
(An additional diagram, if required, can be found on *Page fifteen*.)



2

F

Main Grid

7.	(a)		**Ans: boys with valid reason**	**1**	
Notes:					
	(b)		**Ans: 26, 18, 30** • [1] Process: state the median • [2] Process: state the quartiles	**2**	• [1] 26 • [2] 18, 30
Notes:					
	(c)		**Ans:**  • [1] Strategy: correct end points • [2] Strategy: correct box	**2**	• [1] end points at 10 and 42 • [2] box showing Q_1, Q_2, Q_3

F

Main Grid

8. Elaine goes on a 5 day long business trip to Oslo in Norway.

She changes £750 to Norwegian kroner for the trip.

Rates of exchange	
Pounds Sterling (£)	Other Currencies
1	NOK 8·00 (Norwegian kroner)
1	€1·20 (euros)

(a) How many Norwegian kroner will Elaine receive? **1**

(b) Elaine spends NOK 520 each day she is in Norway.

Her company extends her trip by sending her to Munich in Germany for a further 3 days.

If she changes all her remaining kroner to euros, how many euros will she receive?

She spends €135 each day she is in Munich.

How much money does she have left at the end of her trip?

Give your answer in pounds sterling. **5**

F

Main Grid

8.	(a)		**Ans: NOK 6000** • [1] Process: converts from £ to NOK	**1**	 • [1] $750 \times 8 = 6000$

Notes:

	(b)		**Ans: £87·50** • [1] Process: calculates remaining NOK • [2] Strategy: knows how to convert to euros • [3] Process: converts correctly • [4] Process: calculates remaining euros • [5] Process: converts to sterling correctly	**5**	 • [1] $6000 - 5 \times 520 = 3400$ • [2] Knows to ÷ by 8 and then × by 1·2 • [3] €510 • [4] €510 - 3 × €135 = €105 • [5] 105 ÷ 1·20 = £87·50

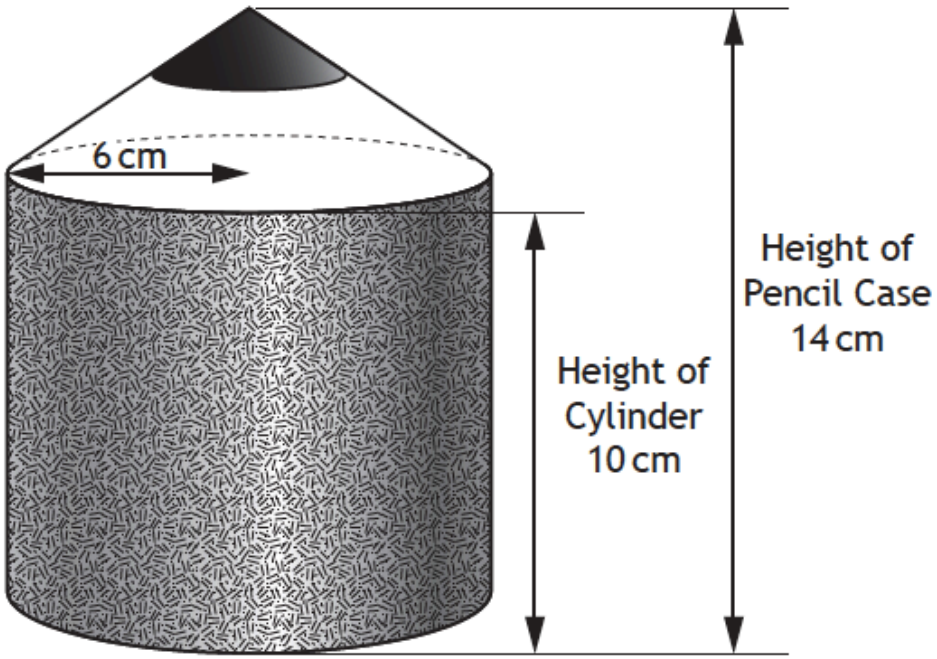
F

Main Grid

9. Robbie has a tub for his crayons.

It is in the shape of a pencil as shown below.

It consists of a cylinder with a cone on top.



Show that the volume of Robbie's tub is 408 π cm^3. 4

F

Main Grid

9.			**Ans: Proof**	4	
			• [1] Strategy: know to add volumes of cone and cylinder		• [1] evidence
			• [2] Strategy: correct substitution into cylinder formula		• [2] $\pi \times 6^2 \times 10$
			• [3] Strategy: correct substitution into cone formula		• [3] $\frac{1}{3}\pi \times 6^2 \times 4$
			• [4] Process: simplify expressions and add to obtain 408 π		• [4] $360\pi + 48\pi = 408\pi$

F

Main Grid

1. Over an eight month period, Goran records how much he spends on his pay-as-you-go mobile phone.

£32, £23, £43, £40, £27, £35, £15, £25.

Calculate the mean and standard deviation for this data. 4

F

Main Grid

1.			**Ans: (£)30, (£)9·30**	**4**	
			• [1] Process: calculate mean		• [1] (32 + 23...) ÷ 8 = 30
			• [2] Process: calculate $(x-\overline{x})^2$		• [2] 4, 49, 169, 100, 9, 25, 225, 25
			• [3] Process: substitute into formula		• [3] $\sqrt{\frac{606}{7}}$
			• [4] Process: calculate standard deviation		• [4] 9·30

F

Main Grid

2. The Yellow Jersey Cycle Shop is a retail store that sells items for outdoor activities.

Alan has a 10% discount card for this store.

He receives a flyer showing the store's monthly deals.

He wants to buy all of the following items.

	**Mountain Bike** Recommended Retail Price £310 Price with discount card £279
	**Helmet** Recommended Retail Price £20 Price with discount card £18
	**Waterproof Jacket** Recommended Retail Price £50 Price with discount card £45
	**Cycling Shorts** Recommended Retail Price £10 Price with discount card £9

Monthly Deal 1	**Monthly Deal 2**
Extra 15% off discounted price when you spend over £75 in store.	Extra 65% off discounted price of bike accessories and clothing when you purchase a bike in store.
Terms & Conditions. 1. Can be used in conjunction with 10% discount card. 2. Not to be used with any other offer or monthly deal. 3. Valid until end of May.	Terms & Conditions. 1. Can be used in conjunction with 10% discount card. 2. Not to be used with any other offer or monthly deal. 3. Valid until end of May.

(a) Which Monthly Deal is better value for Alan?

Justify your answer. **3**

F

*Question Continues On Following Slide

Main Grid

(b) After he has bought the items Alan notices the following on his receipt.

The Yellow Jersey Cycle Shop
Price Guarantee
If any product can be found cheaper (including on special offer) then we will refund the difference plus 10% of the difference.

Alan finds exactly the same items at The Red Polka Dot Cycle Shop who are having a clearance sale.

They are giving 1/3 off the Recommended Retail Price of all the items that Alan has just bought.

How much refund is he entitled to if he uses the **Price Guarantee** from The Yellow Jersey Cycle Shop? **3**

F

Main Grid

2.	(a)	**Ans: Monthly Deal 1 is cheaper** • [1] Process: find price with Monthly Deal 1 • [2] Process: find price with Monthly Deal 2 • [3] Communication: state best Deal	**3**	• [1] (279 + 18 + 45 + 9) × 0·85 = 298·35 • [2] (18 + 45 + 9) × 0·35 + 279 = 304·20 • [3] Monthly Deal 1 is cheaper
	(b)	**Ans: £42·19** • [1] Process: find price for The Red Polka Dot Cycle Shop • [2] Process: find the difference between the price for The Red Polka Dot Cycle Shop and The Yellow Jersey Cycle Shop • [3] Process: calculate total refund	**3**	• [1] (310 +20 +50 + 10) ÷ 3 × 2 = 260 • [2] 298·35 - 260 = 38·35 • [3] 38·35 × 1·1 = 42·19

F

Main Grid

3. A number of oil rigs operate in the North Sea.

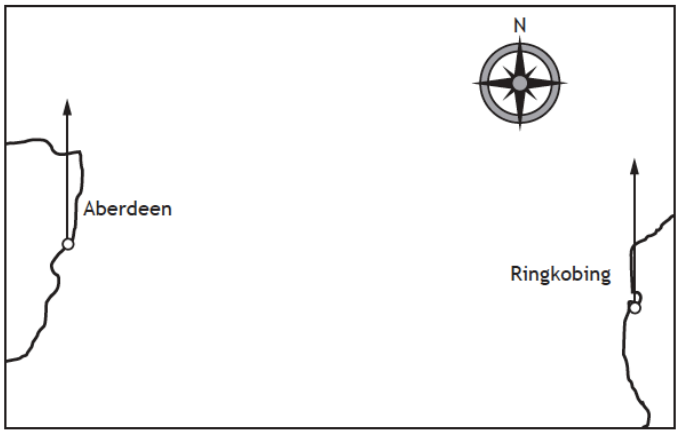
The map below shows part of the North Sea with the ports of Aberdeen and Ringkobing marked.

(An additional map, if required, can be found on *Page fourteen*.)

Scale 1 centimetre represents 50 kilometres

(a) Harkins oil rig is 380 km from Aberdeen on a bearing of 065°.

Show the position of the Harkins oil rig on the map above. 2



(b) A fishing vessel issues an SOS call which is received by both ports.

The bearing of the fishing vessel from each port is shown in the table below.

Bearing from	Three figure bearing
Aberdeen	125°
Ringkobing	250°

(i) Mark the position of the fishing vessel on the map. 3

(ii) Find the distance and bearing of the fishing vessel from the oil rig. 2

F

Main Grid

3.	(a)		**Ans: Mark position** •[1] Process: correct bearing •[2] Process: correct length of line	**2**	•[1] 065 ± 2° •[2] 7·6cm ±0·2cm
	(b)	(i)	**Ans: Mark position** •[1] Strategy: bearing from Aberdeen •[2] Strategy: bearing from Ringkobing •[3] Strategy: mark position	**3**	•[1] Correct bearing of 125° ± 2° •[2] Correct bearing of 250°± 2° •[3] Correctly marks position
		(ii)	**Ans: 340km, 200°** •[1] Communication: Distance of fishing vessel from oil rig • •[2] Communication: Bearing of fishing vessel from oil rig	**2**	•[1] Correct distance of 340±10 •[2] Correct bearing of 200°± 2°

F

Main Grid

4. Saraish bought her house in May 2009 for £130 000.

In the first two years the value of the house increased by 5% per annum.

For the next three years the value of the house decreased by 2% per annum.

(a) What is the value of the house in May 2014?

Give your answer to the nearest thousand pounds. **5**

(b) House prices have risen on average by 4·5% over this five year period.

Has the value of Saraish's house risen in line with this average?

Give a reason for your answer. **2**

F

Main Grid

4.	(a)		Ans: £135 000 •[1] Strategy: know how to increase by 5% •[2] Strategy: increase for 2 years •[3] Strategy: know how to decrease by 2% •[4] Process: calculate value after 5 years •[5] Communication: round to nearest thousand	5	•[1] multiplier of 1·05 •[2] $130\,000 \times 1{\cdot}05^2 = (143325)$ •[3] multiplier of 0·98 •[4] 134 896·34 •[5] 135 000

Notes:
1. £135 000 without working award 0/5
   Do not accept £135 000·00

	(b)		Ans: no value of Saraish's house is about £1000 lower •[1] Process: calculate value after 4.5% rise •[2] Communication: compare values	2	•[1] 135 850 •[2] no value of Saraish's house is lower

F

Main Grid

5. A landscape gardener is designing a garden.

The rectangular garden has dimensions 15 metres by 10 metres.

He plans to build a triangular flower bed.

To separate the flower bed from the lawn, he uses a low fence.

The fence is made of 5 sections, each 2·8 metres long.

A patio in the shape of a quarter circle with a radius of 5 metres is to be created in the corner.

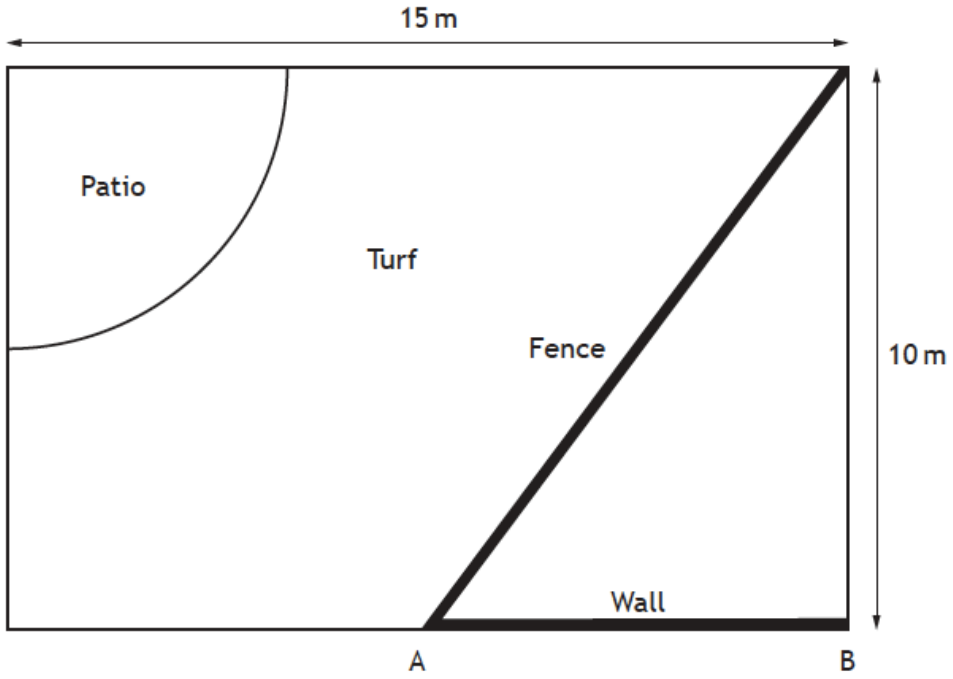
The rest of the garden is to be laid as turf.

A sketch of the garden is shown below.

(a) Calculate the length of the wall, AB. **3**

(b) Turf is sold in $5\,m^2$ rolls costing £14·95 per roll.

Calculate the cost of buying turf for this garden. **6**



F

Main Grid

5.	(a)		Ans: 9·8 metres •[1] Strategy/Process: find the hypotenuse •[2] Strategy: know to use correct form of Pythagoras •[3] Process: calculate the length of the wall	3	•[1] $5 \times 2{\cdot}8 = 14$ •[2] $14^2 - 10^2$ •[3] 9·8
Notes:					
	(b)		Ans: £254·15 •[1] Strategy: know to calculate area •[2] Process: area of triangle •[3] Process: area of quarter circle •[4] Process: area for turf •[5] Strategy: know how to calculate the number of rolls •[6] Process: calculate cost	6	•[1] Rectangle - quarter circle - triangle •[2] 49 •[3] 19·6 •[4] 150 - 49 - 19·6 = 81·4 •[5] 17 •[6] $17 \times 14{\cdot}95 = 254{\cdot}15$

F

Main Grid

6. The table shows the qualifying times at the Malaysian 2013 Grand Prix.

The qualifying times are for 1 lap of the track.

The track is 5·543 kilometres long.

There are 56 laps in this Grand Prix.

	Driver	Team	Qualifying Time (min: sec)
1	Sebastian Vettel	Red Bull	01:49·7
2	Felipe Massa	Ferrari	01:50·6
3	Fernando Alonso	Ferrari	01:50·7
4	Lewis Hamilton	Mercedes	01:51·7
5	Mark Webber	Red Bull	01:52·2
6	Nico Rosberg	Mercedes	01:52·5

(a) Vettel's time was 1 minute 49·7 seconds.

By how much time did Vettel beat Massa? 1

(b) What was Lewis Hamilton's average speed in his qualifying lap?

Round your answer to the nearest km/h. 5

(c) Nico Rosberg's average lap time for the Grand Prix was 1 minute 54·8 seconds.

How long did it take him to complete the Grand Prix?

Give your answer in hours, minutes and seconds. 4

F

Main Grid

6.	(a)		Ans: 0·9s •[1] Process: find time difference	1	•[1] 1:50·6 - 1:49·7

Notes:

	(b)		Ans: 179 (km/hr) •[1] Strategy: extract data and substitute •[2] Process: convert time to seconds •[3] Process: calculate speed in km/s •[4] Strategy: know how to convert to km/hr •[5] Communication: round answer correctly	5	•[1] S= 5·543/01:51·7 •[2] 111·7 •[3] 5·543/111·7 = 0·0496... •[4] x 3600 •[5] 179
	(c)		Ans: 1 hour 47 minutes 8·8 seconds •[1] Strategy: know to convert time and multiply by 56 •[2] Strategy: convert to minutes •[3] Strategy: convert to hours, minutes and seconds •[4] Process: all calculations correct	4	•[1] 114·8 x 56 (=6428·8 secs) •[2] ÷ 60 (107·146...mins) •[3] 0·146...mins into seconds (8·8) •[4] 1 hour 47 minutes 8·8 seconds

F

Main Grid

7. Cameron wants to resurface his drive.

He has a choice of 3 surfaces.

SURFACE TYPE 1: TARMAC
A tarmac drive should last for 30 years.

Tarmac costs £2 per square foot to lay.

(1 square metre = 10·76 square feet)

SURFACE TYPE 2: GRAVEL CHIPS
A gravel drive should last for 10 years.

Gravel needs to be laid to a depth of 5 cm.

Each 50 kg bag will cover 1 square metre to a depth of 5 cm.
Each 50 kg bag costs £8·29
Each 850 kg bag costs £125·99

The gravel needs a weedproof membrane to be laid underneath.
Membrane to cover the drive costs £14·31.

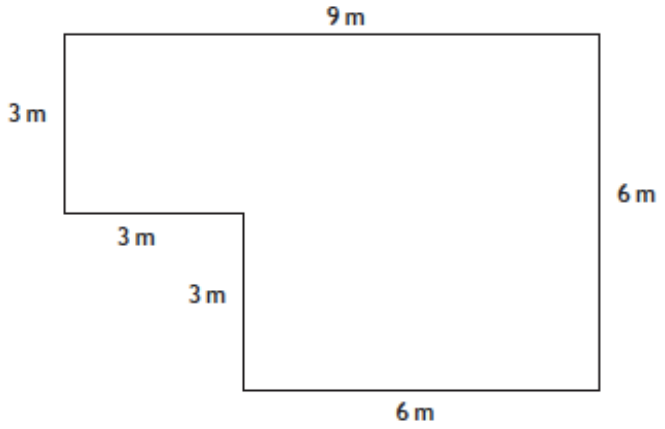
SURFACE TYPE 3: CONCRETE SLABS
A concrete slab drive should last for 25 years.

Concrete slabs:
40 cm by 40 cm ---------- £2·12 each
Slabs can be cut to size

Slabs require 4 cm depth of hardcore to be laid underneath.
1 cubic metre = 2 tonnes hardcore.
Hardcore costs £18 per tonne bag.

2 bags of mortar at £35·99 per bag.

Cameron makes a sketch of his drive to help him to calculate the cost of each type of surface.



(a) Calculate the minimum total cost for each surface type. 9

(b) Which is the most cost effective? 3

F

Main Grid

7.	(a)		Ans: £968·40, £357·48, £741·82	9	
			• [1] Process: calculate area of drive in square feet		• [1] 45 m^2 × 10·76 = 484·2 sq ft
			• [2] Process: calculate price for tarmac		• [2] 484·2 × £2 = £968·40
			• [3] Process: calculate how much gravel is needed		• [3] 45 x 50 = 2250kg
			• [4] Strategy: find best way to buy the gravel		• [4] 2 × 850kg + 11 × 50kg
			• [5] Process: find total cost of using gravel		• [5] 2 × £125·99 + 11 × £8·29 + £14·31 = £357·48
			• [6] Strategy: know to calculate minimum number of slabs		• [6] Evidence
			• [7] Process: calculate number of slabs		• [7] 15 × 15 + 7 × 7 + 8 = 282 Or 45 ÷ 0.16 = 282 (rounded up)
			• [8] Process: calculate amount of hardcore needed		• [8] 45 m^2 × 0·04 m = 1·8 m^3 2 × 2 = 4 tonnes
			• [9] Process: calculate price of slabbed drive		• [9] 282 × £2·12 + 4 × £18 + 2 × £35·99 = £741·82
	(b)		Ans: Choice of surface plus reason	3	
			• [1] Strategy: know to find cost per year for each		• [1] 968·40 ÷ 30, 357·48 ÷ 10, 741·82 ÷ 25
			• [2] Process: calculate the 'cost per year' for each surface type		• [2] Tarmac costs £32·28 per year Gravel costs £35·75 per year Slabs cost £29·67 per year
			• [3] Communication: state conclusion with valid reason		• [3] Slabs cheapest per year, or gravel cheaper initially etc

Main Grid

1. Carol knows that she can travel 280 miles on a full tank of fuel. She is making a trip of 110 miles.

The diagram below shows the car's fuel gauge

Does she have enough fuel to make the journey?

Show working to justify your answer. **2**

F

Main Grid

1.			Ans: No, supported by working • [1] Process: calculate fraction of • [2] Communication: state conclusion	2	• [1] $3/8 \times 280 = 105$ • [2] $105 < 110$

F

Main Grid

2. Usain flies from London to Moscow for a business meeting.

The plane leaves London at 1845.

The flight takes 3 hours and 40 minutes.

Moscow time is 4 hours ahead of London.

It should take 45 minutes to collect his luggage and clear security.

His company arranges for a driver to collect him from Moscow Airport.

At what time should the driver expect to collect Usain? **2**

F

Main Grid

2.			Ans: 0310/3·10am • [1] Strategy: knows how to deal with time zone, flight time and security clearance • [2] Process/communication: state time	2	• [1] Evidence of adding all three times in the question on to 1845 • [2] 0310

F

Main Grid

3. Freddie and Kamal work in a warehouse stacking shelves.

A section of the warehouse has 5 shelves; each shelf is 10 metres in length.

The shelves are currently stocked as shown below.

Shelf 1	Box A (7 m)
Shelf 2	Box B (5 m)
Shelf 3	Box C (6 m) Box D (3 m)
Shelf 4	Box E (4 m) Box F (3 m)
Shelf 5	Box G (2 m)

Shelf 1	
Shelf 2	
Shelf 3	
Shelf 4	
Shelf 5	

A new delivery of Box H (6 m), Box I (5 m), Box J (3 m), Box K (4 m), Box L (1 m) arrives to be stored in this section of the warehouse.

These new boxes need to be stored on different shelves from the existing stock.

The existing stock can be re-arranged to create space for the new delivery.

By writing the letters A to L in the diagram below, show how Freddie and Kamal can fit **all** the boxes onto the shelves.

(An additional diagram, if required can be found on *Page eleven)* **2**

F

Main Grid

3.		Ans: A, D or F B, G, F or D C, E H, K I, J, L • [1] Strategy: attempt to re-arrange existing packages and add new packages • [2] Communication: arrange boxes on shelves	2	• [1] Rearrange old stock onto 3 shelves • [2] Arrange new stock onto remaining 2 shelves

F

Main Grid

4. A company orders a batch of washers with a thickness of $2{\cdot}4 \pm 0{\cdot}05$ mm.

A quality control inspector takes a sample from the batch of washers.

The thicknesses, in mm, of the washers in this sample are shown below.

2·44, 2·37, 2·36, 2·45, 2·35

2·35, 2·44, 2·43, 2·34, 2·40

2·40, 2·41, 2·39, 2·38, 2·46

2·41, 2·39, 2·53, 2·36, 2·37

For the batch to be accepted, at least 88% of the washers in this sample must be within tolerance.

Will the batch be accepted? **3**

F

Main Grid

4.			**Ans: No, supported by working** • [1] Strategy: know to use upper/ lower limits • [2] Process: calculate % within tolerance • [3] Communication: state conclusion	3	• [1] Evidence of 2·35 and 2·45 (may be implied in [2]) • [2] 17/20 = 85% • [3] No, as 85% < 88%
			Alternative Strategy 1: • [1] Strategy: know to use upper/ lower limits • [2] Process: calculate % outwith tolerance • [3] Communication: state conclusion		• [1] Evidence of 2·35 and 2·45 (may be implied in [2]) • [2] 3/20 = 15% • [3] No, as 15%>12%
			Alternative Strategy 2: • [1] Strategy: know to use upper/ lower limits • [2] Process: calculate minimum number needed for batch to be accepted • [3] Communication: state conclusion		• [1] Evidence of 2·35 and 2·45 (may be implied in [2]) • [2] 88% of 20 = 17·6, ie need 18 • [3] No, as only 17 in tolerance, so batch fails

F

Main Grid

5. A shop sells Ice Cola in 330 millilitre cans.

An individual can costs 66 pence.

Complete the shelf label for Ice Cola below to show the price per litre.

2

330 ml	equivalent to	1 litre
66p		_____

F

Main Grid

5.			Ans: £2(·00)/200p per litre • [1] Strategy: know to use proportion • [2] Process: price per litre	2	 • [1] $\frac{66}{330} \times 1000$ • [2] 200p = £2(·00)
			Alternative Strategy: • [1] Strategy: know to use proportion • [2] Process: price per litre		• [1] 3 × 330ml +10ml →3 × 66p + ?, where ? < 66p • [2] 198p + 2p = 200p = £2(·00)

F

Main Grid

6. Mhairi buys 200 shares for £700.

When she decides to sell them, the share price has dropped to £2·75 per share.

She has to pay a fee of 2½% of her selling price when she sells her shares.

Calculate the loss that she has made. **4**

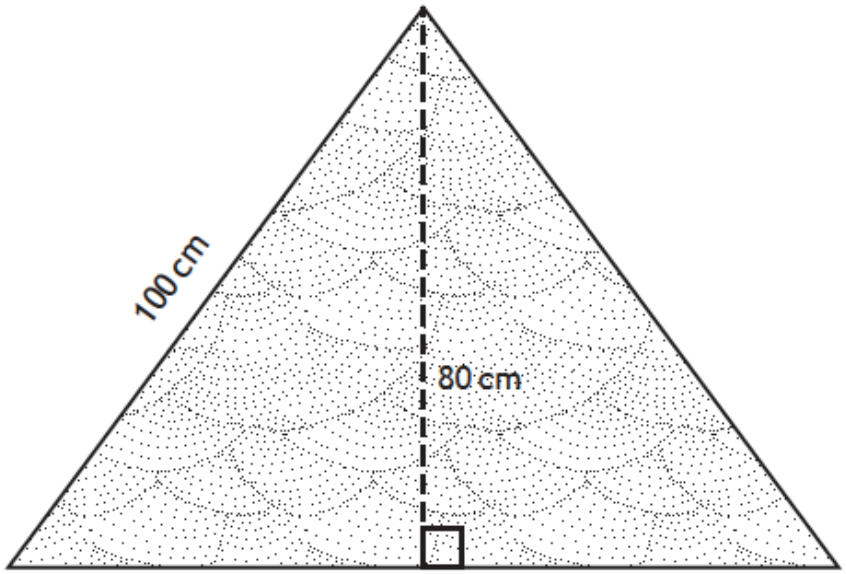
F

Main Grid

6.			**Ans: £163·75**	4	
			• [1] Process: calculate selling price of the shares		• [1] 200 × £2·75 = £550
			• [2] Process: calculate 2½% of selling price		• [2] 2½% of £550 = £13·75
			• [3] Process: calculate amount she receives		• [3] £550 - £13·75 = £536·25
			• [4] Process: calculate loss		• [4] £700 - £536·25 = £163·75
			Alternative Strategy: single share basis:		
			• [1] Process: calculate price per shares		• [1] £700 ÷ 200 = £3·50
			• [2] Process: calculate loss		• [2] 200 × £0·75 = £150
			• [3] Process: calculate fee		• [3] 2·5% of (£700 - £150) = £13·75
			• [4] Process: calculate loss		• [4] Calculate total loss: £150 + £13·75 = £163·75

F

7. Lucy has a scarf in the shape of an isosceles triangle with dimensions as shown below.



Lucy wants to sew ribbon along all three edges of the scarf.

She has 3·5 metres of ribbon.

Does Lucy have enough ribbon for the scarf?

Show all working and justify your answer. 4

F

Main Grid

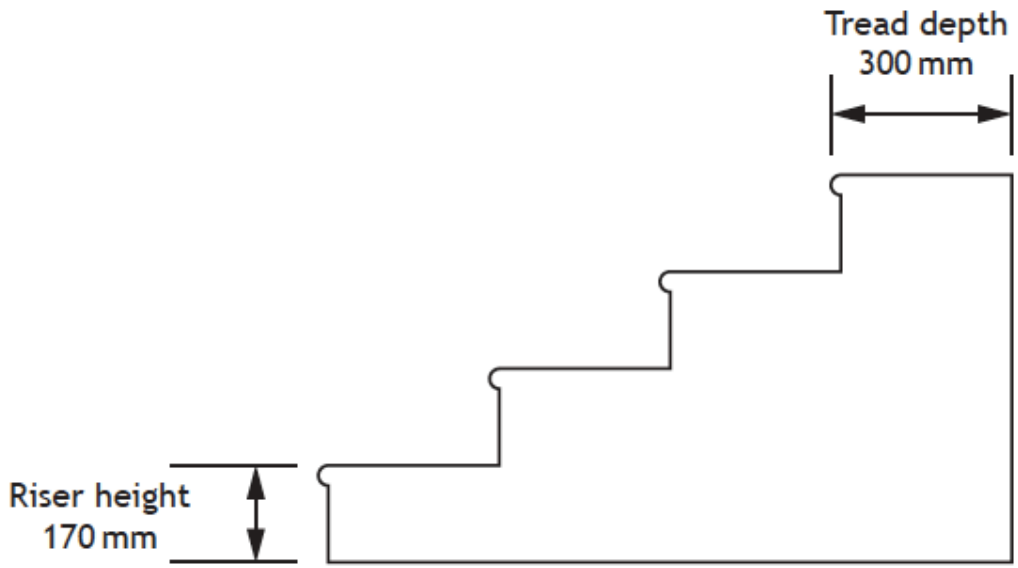
7.		**Ans: Yes, since 3·5m > 320cm** • [1] Strategy: Know to use correct form of Pythagoras' Theorem • [2] Process: Calculate half of third side of scarf • [3] Process: Calculate perimeter • [4] Communication: Yes with justification	4	• [1] $c^2 = 100^2 - 80^2$ or $c^2 + 80^2 = 100^2$ • [2] $\sqrt{3600} = 60$ • [3] $100 + 100 + 2 \times 60 = 320$ • [4] Yes, since 3·5m > 320cm Or she will have 30cm extra

F

Main Grid

8. The diagram below shows a staircase Mark intends to install in his home.

The dimensions of the riser and tread of each step are shown.



For safety reasons, these rules must be applied.

- Twice the riser height plus the tread depth should be 625 mm ±15 mm.
- The gradient of each step should be less than ½.

Mark thinks that this staircase will meet both of these rules.

Is Mark correct?

Use your working to justify your answer. 5

F

Main Grid

8.			**Ans: Rule 1: Yes as 640 is upper limit of tolerance** **Ans: Rule 2: No as 17/30>½** • [1] Strategy: know to check both rules • [2] Process: find 2 × riser + tread • [3] Communication: within tolerance, so passes rule 1 • [4] Process: calculate gradient • [5] Communication: shows that gradient > ½ , so fails rule 2	**5**	• [1] evidence • [2] 2 × 170 + 300 = 640 • [3] 625±15; range 610 - 640; 640 is within this range • [4] 170/300 or equivalent • [5] 170/300>½, so fails rule 2

F

9. Novak is going to buy a new computer system. He researches online to find the prices from different retailers.

Retailer	Keyboard	Monitor	Computer Tower	Mouse	Printer
Easy Comp	50	130	130	15	95
ABC	45	135	140	20	75
Compact	30	125	180	25	120
Hardy's	70	130	165	15	125
Tonda	35	115	150	20	80
Disme	40	120	180	10	105

All prices are in £s

(a) Novak needs to buy one of each item. He is happy to buy these from different retailers.

What is the minimum total cost for his new computer system? 1

(b) Novak cannot afford to pay for his computer system all at once.

Disme can provide a finance package to buy the complete computer system.

The deposit is 10% of the cash price, followed by 12 payments of £40.

He chooses to buy the complete computer system from Disme using their finance package.

How much more than the minimum total will this cost him? 4

F

Main Grid

9.	(a)		**Ans: £360**	**1**	
			• [1] Process: correct total		• [1] Total = £360

Notes:

	(b)		**Ans: £165·50**	**4**	
			• [1] Strategy: knows how to calculate finance package		• [1] Evidence of attempt to find deposit **and** attempt to find total finance package
			• [2] Process: calculate deposit		• [2] 10% of (40 + 120 + 180 + 10 + 105) = £45·50
			• [3] Process: find total finance package		• [3] £45·50 + 12 × £40 = £525·50
			• [4] Communicate: state extra cost		• [4] £525·50 - £360 = £165·50

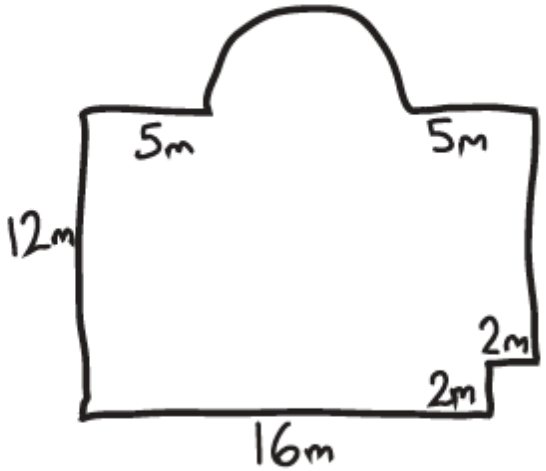
F

Main Grid

10. A hotel is redecorating their function room which includes a semi-circular stage area.

They plan to lay a hardwood floor.

A sketch of the floor plan of the room is shown below.



(a) Calculate the area of the floor in the hotel's function room.

Use $\pi = 3{\cdot}14$. 4

(b) Hardwood flooring comes in packs of $4m^2$ and is sold at £67·95 per pack.

Calculate the cost for the hotel to floor their function room. 2

F

Main Grid

10.	(a)		**Ans: 237·12m^2**	**4**	
			• [1] Strategy: find radius of semi-circle		• [1] r = 4
			• [2] Process: calculate area of semi-circle		• [2] A = ½ × 3·14 × 4^2 = 25·12
			• [3] Process: calculate remaining area		• [3] A = 18 × 12 - 2 × 2 = 212
			• [4] Process: calculate total area		• [4] A = 212 + 25·12 = 237·12

Notes:

• [1] may be implied by • [2]

A common incorrect response:

If radius taken as 3m → A = ½ × 3·14 × 3^2 = 14·13 → 212 + 14·13 = 226·13m^2 award 3/4

	(b)		**Ans: £4077**	**2**	
			• [1] Strategy: find minimum number of packs		• [1] 237·12 ÷ 4 = 59·28 Therefore 60 packs required
			• [2] Process: calculate cost		• [2] 60 × £67·95 = £4077

F

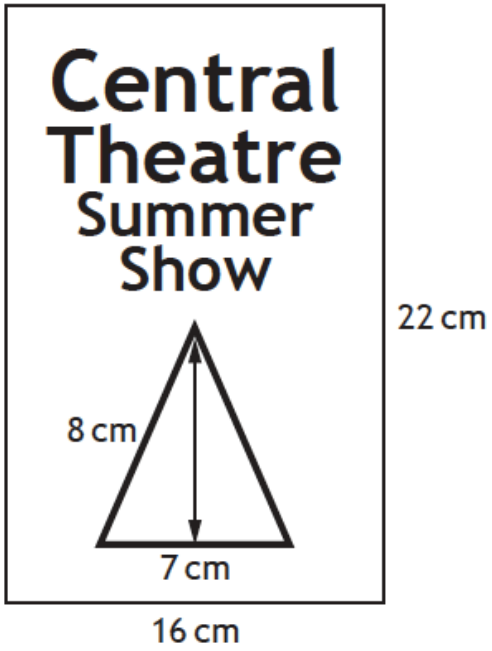
1. Publicity material is to be designed for a theatre show that is being sponsored by a local company.

All the publicity material must feature the company logo.

The company logo is in the shape of a triangle.

The designer is to produce a small "flyer" and a large poster.

The designer produces a sketch for the flyer as shown.



(a) The ratio of the dimensions in the poster to those in the flyer is 7:2.

Calculate the dimensions of the logo as it will appear on the poster. **2**

(b) The design brief specifies that the company logo must be between 9% and 12% of the area of any publicity material.

Does this design fit these specifications? **4**

F

Main Grid

1.	(a)	**Ans: Logo is 24·5/28(cm) base/ height** •[1] Strategy: interprets ratio and attempts to find dimensions of the logo •[2] Process: calculate both dimensions of the logo	**2**	 •[1] Evidence eg 8 × 7 ÷ 2 •[2] 24·5cm by 28cm
	(b)	**When 8cm is taken as the height of the triangle.** **Ans: No, supported by working** •[1] Strategy: attempt to express area of logo as a percentage of area of rectangle •[2] Process: calculate areas of rectangle and triangle •[3] Process: calculation of percentage •[4] Communication: conclusion consistent with working	**4**	 •[1] Evidence •[2] 22 × 16 = 352 ½ × 7 × 8 = 28 •[3] 28 ÷ 352 × 100 = 7·9545... •[4] No, logo is 8% which is less than the necessary 9%

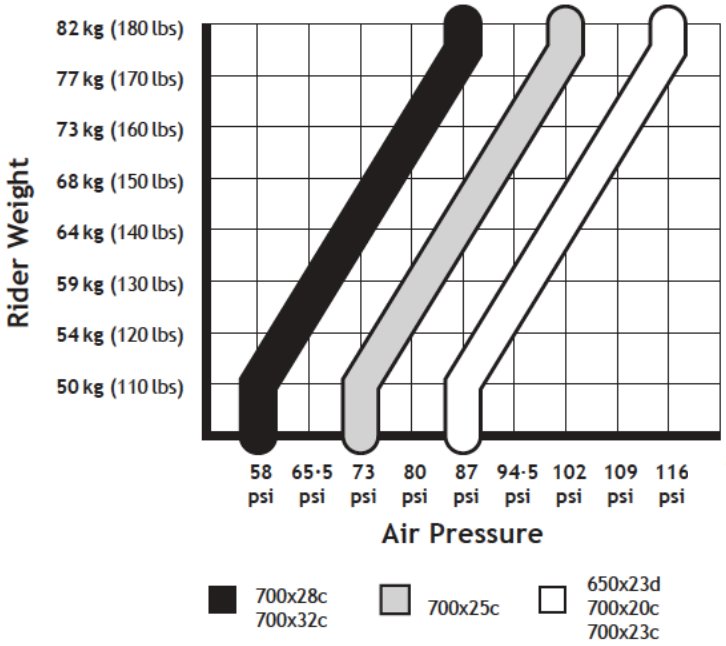
F

Main Grid

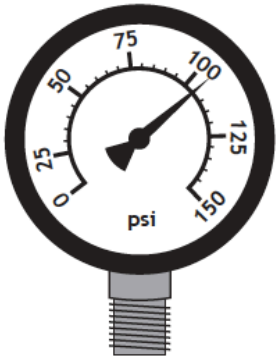
2. Patryk is a keen cyclist.

Before Patryk goes for a cycle he checks the recommended air pressure for his tyres using the graph below.

Patryk weighs 73 kilograms and he is using 700 × 23C tyres.



The gauge below shows the reading when he checks his front tyre.



(a) State any adjustment Patryk should make so that his tyre has the correct air pressure. 3

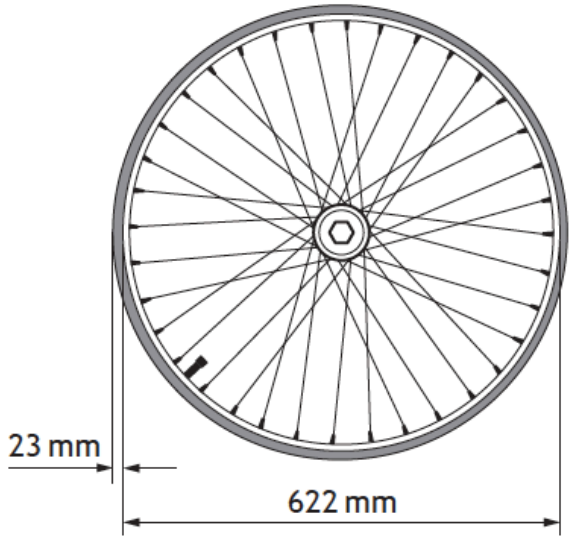
F

Main Grid

Patryk has a bicycle trip computer.

To calibrate the computer he must enter the circumference of the front tyre of his bicycle.

The diameter of the rim is 622 millimetres and the depth of the tyre is 23 millimetres as shown in the diagram below.



(b) What value should Patryk enter into his bicycle trip computer?

Round your answer to the nearest millimetre. 3

F

Main Grid

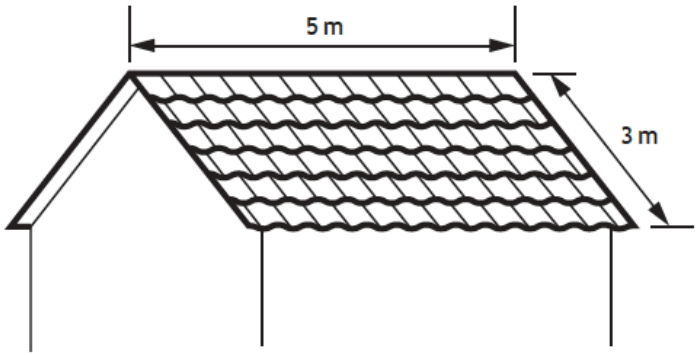
2.	(a)		**Ans: Answer consistent with working eg add 4 (psi) or lose 5kg in weight or add more air so it reads 109psi** • [1] Communication: reading from gauge • [2] Communication: identify correct psi from graph • [3] Communication: state conclusion	3	• [1] 105 • [2] 109 • [3] Add 4 or add more air so it reads 109(psi)
	(b)		**Ans: 2099 (mm)** • [1] Strategy/process: calculate the diameter • [2] Process: calculate circumference • [3] Communication: round to nearest millimetre	3	• [1] 23 + 622 + 23 = 668 • [2] $C = \pi \times 668 = 2098{\cdot}58....$ • [3] 2099

F

Main Grid

3. Mrs Smith has decided to get the roof of her extension re-slated.

She contacts a local roofing contractor to get an estimate.



Each side of the roof has dimensions 5 m by 3 m as shown.

The builder gives her a quote for the replacement slates.

He uses the following method to work out his estimate:

- calculate the area of one side
- double this (total area)
- double again (overlapping slates)
- multiply by 16 (to get the number of slates required)
- add on 15% (for cuts and breakages).

The cost of each slate is 97 pence.

He rounds his estimate to the nearest hundred pounds.

The builder tells Mrs Smith he will "throw in" any additional materials for free.

(a) How much is the estimate for replacement slates?

Mrs Smith asks for a total price including labour.

The builder works this out using the following:

Strip and clean roof — 8 hours

Replace slates — 1 square metre/ hour

Rate — £22 per hour.

(b) How much will the labour costs be? 2

(c) Mrs Smith will go ahead with the work if the written estimate is less than £2,500.

Complete the written estimate below.

Written Estimate

Client Mrs Smith

Estimated cost of slates £

Labour Costs £

Sub-total £

VAT at 20% £

TOTAL COST £

Will Mrs Smith accept the builder's estimate? 2

F

Main Grid

3.	(a)		**Ans:£1100** • [1,2] Strategy/Process: extract information and calculate cost of slates (Award 1/2 if there is 1 missing or incorrect step) • [3] Communication: round to nearest £100	3	• [1,2] (5 × 3) × 2 × 2 × 16 × 1·15 × 0·97 = 1070·88 • [3] 1100
	(b)		**Ans: £836** • [1] Strategy: know how to calculate total • [2] Process: calculate labour costs	2	• [1] (8 × 22)+(15 × 2 × 22) • [2] 836
	(c)		**Ans: Yes, supported by working** • [1] Process: complete estimate • [2] Communication: yes, supported by working	2	• [1] Slates 1100 Labour 836 Sub-total 1936 VAT 387·20 Total 2323·20 • [2] Yes, supported by working

F

Main Grid

4. A seaplane flies from an airport on a bearing of 050° at a speed of 170 mph for 36 minutes.

It then turns onto a new bearing of 190° and flies at the same speed for a further 1 hour 12 minutes.

(a) Construct a scale drawing to illustrate this journey.

Use a scale of 1 cm:20 miles 4

The seaplane continues at the same speed back to the airport.

(b) Use the scale drawing to determine the distance and bearing of the airport from the seaplane. 2

The seaplane burns fuel at 32 litres per hour.

Aviation fuel costs £2·04 per litre.

(c) Calculate the cost of the fuel for the complete journey. 4

F

Main Grid

4.	(a)		**Ans: Route correctly drawn** • [1] Process: calculate distance for legs • [2] Process: calculate scale distance • [3] Process/communication: correct bearing measured & correct length drawn • [4] Process/communication: 2nd bearing and length correctly drawn	**4**	 • [1] 170 × 0·6 = 102 170 × 1·2 = 204 • [2] 102 ÷ 20 rep by 5·1 cm 204 ÷ 20 rep by 10·2 cm • [3] Bearing of $050^0(\pm 2^0)$ measured correctly and 51(±2)mm line drawn • [4] Bearing of 190^0 $(\pm 2^0)$ measured correctly and 102(±2) mm line drawn
	(b)		**Ans: 342^0 ,142 miles** • [1] Process: correct bearing • [2] Process: correct distance in miles	**2**	 • [1] 342^0 • [2] 142 miles
	(c)		**Ans: £172·03** • [1] Process: calculates total distance • [2] Process: calculates total time taken as a decimal • [3] Strategy: knows how to find total cost of fuel used • [4] Process: calculates fuel cost	**4**	 • [1] 102 + 204 + 142= 448 miles • [2] 448 ÷ 170 = 2·6352... hours • [3] evidence of time × 32 × £2·04 • [4] 2·6352... × 32 × 2·04 = 172·03

Main Grid

5. The local youth club runs a weekly tuck shop. Any profit that is made is donated to a local charity.

The stem and leaf diagram shows their weekly takings for the first 6 months of this year.

0	5	7	7	8	9	9				
1	0	2	5	6	6	7	8	8	8	9
2	0	1	1	2	3	5				
3	0	4								

n = 24 3 | 4 represents £34

(a) (i) State:

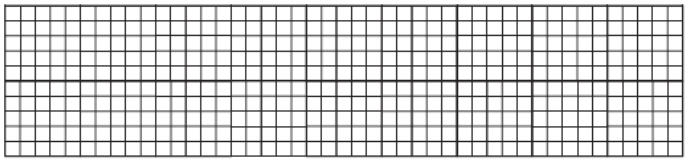
the median

the lower quartile

the upper quartile. 2

(ii) Using the above data construct a boxplot in the space provided.

(An additional diagram, if required, can be found on *Page fourteen*) 2



F

Main Grid

(b) The monthly profits, in pounds, for the second 6 months of this year, are recorded below.

22 16 25 19 18 20

Calculate:

(i) the mean monthly profit. 1

(ii) the standard deviation.

Round your answer to the nearest penny. 3

(c) The mean profit and standard deviation, for the same period, the previous year was £16·25 and £2·40 respectively.

Make two valid comparisons between these. 2

(d) The local youth club thinks that the mean donations have increased by 25%.

Are they correct? 2

F

Main Grid

5.	(a)	(i)	**Ans: Q_2 = (£)17·50** **Q_1 = (£)9·50, Q_3 = (£)21** •[1] Communication: correct median •[2] Communication: upper and lower quartiles	**2**	 •[1] Q_2 = 17·50 •[2] Q_1 = 9·50, Q_3 = 21
		(ii)	**Ans: Boxplot drawn correctly showing 5-fig summary** •[1] Communication: correct end points •[2] Communication: correct box	**2**	 •[1] end points at 5 and 34 •[2] box showing Q_1, Q_2, Q_3
	(b)	(i)	**Ans: $\bar{x} = (£)20$** •[1] Process: calculate mean	**1**	 •[1] $\bar{x} = 20$
		(ii)	**Ans: s = (£)3·16** •[1] Process: calculate $(x - \bar{x})^2$ •[2] Process: substitute into formula •[3] Process: calculate standard deviation	**3**	 •[1] 4,16,25,1,4,0 •[2] $\sqrt{\frac{50}{5}}$ •[3] 3·16
	(c)	(c)	**Ans: 2 valid comments** •[1] Communication: comment regarding the mean •[2] Communication: comment regarding the s.d.	**2**	 •[1] On average there is more profit being made this year •[2] There is more variation in profit this year
	(d)		**Ans: No, as 23% < 25%** •[1] Process: calculate percentage change •[2] Communication: state increase	**2**	 •[1] 20 - 16·25 = 3·75 $\frac{3·75}{16·25} \times 100 = 23\%$ •[2] No, as 23% < 25%
			Alternative Strategy: **Ans: No, as £20·31 > £20** •[1] Process: calculate 25% increase in mean •[2] Communication: conclusion		 •[1] 16·25 × 1·25 = 20·31 •[2] No, as 20·31 > 20

F

Main Grid

6. In a diving competition there are seven judges.

Each judge gives the diver a raw score out of 10.

Each dive has a difficulty rating.

A rule is then applied which calculates the diver's final score.

The rule is:

- discard the lowest and highest raw scores
- work out the mean of the remaining raw scores
- multiply the mean by 3/5
- multiply this value by the difficulty rating
- round to 1 decimal place.

The table shows the judges' raw scores for two competitors.

Diver	Difficulty rating	Judges' raw scores						
		1	2	3	4	5	6	7
Cheryl	3·2	9·0	9·5	9·0	8·5	7·5	8·5	8·0
Ha-lin	3·5	8·5	7·0	7·5	8·5	8·0	7·5	9·0

(a) In this round, Ha-lin's final score is 16·8.

Is this higher or lower than Cheryl's final score? **4**

(b) Cheryl will win the competition if she achieves a final score of 16·9 in her last dive.

(i) If she maintains her mean score from part (a), what is the minimum level of difficulty of dive Cheryl would need to win the competition? **3**

F

Main Grid

6 (b) (continued)

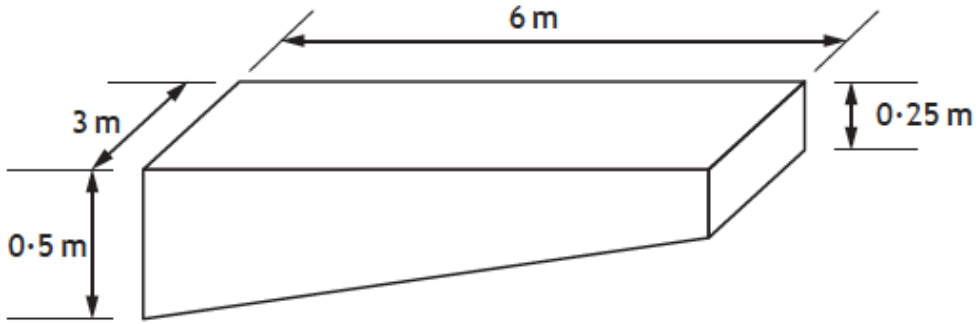
(ii) If Cheryl chooses a dive with a difficulty rating of 3·4, what mean score would she need to receive from the judges to win the competition? **3**

(c) Regulations state that a 10 metre high diving platform must be:

- 6 m in length
- 3 m in width
- 0·25 m deep at front edge, and 0·5 m at back edge
- made of concrete.

The diagram shows one such platform.

Will 7 m^3 of concrete be enough to build the platform? **4**



F

Main Grid

6.	(a)		**Ans: It is higher (16·8>16·5)**	**4**	
			• [1] Strategy: selects correct row and discards highest and lowest scores		• [1] Evidence
			• [2] Process: calculate mean		• [2] 43 ÷ 5 = 8·6
			• [3] Process: calculate final score		• [3] 8.6 × 3/5 × 3·2=16·5
			• [4] Communication: compare		• [4] 16·8>16·5
	(b)	(i)	**Ans: 3·3**	**3**	
			• [1] Strategy: know to divide by 8·6		• [1] 16·9 ÷ 8·6
			• [2] Strategy: know to divide by 3/5		• [2] …..÷ 3/5
			• [3] Communication: state level of difficulty		• [3] 3·3
		(ii)	**Ans: 8·3**	**3**	
			• [1] Strategy: know order of calculations		• [1] evidence of ÷ 3·4 × 5/3
			• [2] Process: calculate score before difficulty factor		• [2] 16·9 ÷ 3·4 = 4·97…
			• [3] Process: find the mean score		• [3] 4·97 × 5/3 = 8·3
	(c)		**Ans: Yes as 7>6·75**	**4**	
			• [1] Strategy: attempt to calculate the volume of a prism		• [1] evidence of cuboid + prism or Ah
			• [2] Process: set up calculation		• [2] 3 × 6 ×·25 + ½ × 6 × 0·25 ×3 or (½ × 6 × 0·25 + 6 × 0·25) ×3
			• [3] Process: calculate volume		• [3] 6·75m^3
			• [4] Communication: state conclusion		• [4] Yes as 7>6·75

F

Main Grid

1. A restaurant can buy long grain rice in two sizes of bags.

- A 9 kg bag costs £25·65
- A 20 kg bag costs £57·20

Which size of bag is better value for the restaurant?

Use your working to justify your answer. 3

F

Main Grid

1.			Ans: 9 kg bag supported by working • [1] Strategy: attempt to find price of 1kg of each • [2] Process: finds price of one kg of each. • [3] Communication: select best value	• [1] £25·65 ÷ 9 and £57·20 ÷ 20 • [2] £2·85 and £2·86 • [3] 9 kg bag better value	3

F

Main Grid

2. Aneesha and Brian are playing a board game. Each move is determined by rolling two dice.

Aneesha requires a total of **10 or more** on her next roll to win the game.

What is the probability of Aneesha winning the game on the next roll?

Give your answer as a fraction. 3

F

Main Grid

2.			Ans: 6/36 (1/6) • [1] Strategy: know to find total combinations • [2] Process: find all combinations totalling 10 or more • [3] Communication: state fraction	• [1] evidence of the 36 combinations • [2] 6 combinations • [3] 6/36 (= 1/6)	3

F

Main Grid

3. Gary lives in Biggar and has to go to a meeting in Edinburgh.

He plans to travel to his meeting by bus.

He uses this bus timetable to plan his journey.

Dumfries ● Biggar ● Edinburgh

Monday to Friday

Route Number	101	101	101	101	101	102	101	101	101	101	101	102
Dumfries Whitesands Stance 4		**0535**	**0710**		**0910**	**1025**			**1315**			**1815**
Heathhall		0543	0720		0920	|			1325			|
Amisfield Main Rd		0547	0725		0925	|			1330			|
Parkgate		0552	0730		0930	|			1335			|
St Ann's		0557	0736		0936	|			1341			|
Beattock Primary School		0606	0745		0945	|			1350			|
Moffat High St Stance 2		**0612**	**0752**		**0952**	|			**1357**			|
Holywood		|	|		|	1031			|			1821
Auldgirth		|	|		|	1039			|			1829
Closeburn		|	|		|	1046			|			1836
Thornhill Cross		|	|		|	1050			|			1840
Durisdeermill		|	|		|	1100			|			1850
Troloss		|	|		|	1105			|			1855
Elvanfoot		|	|		|	1117			|			1907
Crawford		0633	0813		1013	1128			1418			1913
Abington Village		0640	0820		1020	1135			1425			1920
Abington Service Area		0646	0827		1027	1142			1432			1927
Roberton		0651	0832		1032	1147			1437			1932
Lamington		0657	0838		1038	1153			1443			1938
Coulter		0702	0843		1043	1158			1448			1943
Biggar	**0633**	**0709**	**0853**	**0953**	**1053**	**1208**	**1253**	**1353**	**1458**	**1623**	**1803**	**1953**
Dolphinton	0644	0721	0905	1004	1104	1219	1304	1404	1509	1634	1814	2004
West Linton	0651	0731	0915	1011	1111	1226	1311	1411	1516	1641	1821	2011
Carlops	0655	0735	0920	1015	1115	1230	1315	1415	1520	1645	1825	2015
Silverburn	0702	0741	0927	1021	1121	1236	1321	1421	1526	1651	1831	2021
Penicuik Town Centre Stop C	0707	|	0932	1026	|	1241	1326	1426	|	1656	1836	2026
Flotterstone	0717	0746	0942	1036	1126	1251	1336	1436	1531	1706	1846	2034
Fairmilehead, Swanston Drive	0724	0753	0948	1042	1132	1257	1342	1442	1537	1712	1852	2039
Morningside Station	0732	0801	0956	1050	1140	1305	1350	1450	1545	1720	1900	2045
Tollcross	0740	0809	1004	1058	1148	1313	1358	1458	1553	1728	1908	2050
Lothian Road, Caledonian Hotel	0749	0818	1011	1104	1154	1319	1404	1504	1600	1735	1914	2055
Edinburgh Bus Stance E	**0801**	**0830**	**1021**	**1114**	**1204**	**1329**	**1414**	**1514**	**1611**	**1745**	**1924**	**2102**

His meeting in Edinburgh starts at 11:30 am.

It will take him 25 minutes to walk from the Edinburgh bus stance to his meeting.

What is the latest bus he can catch in Biggar to be at his meeting on time? 2

F

Main Grid

3.			Ans: 0853 (from Biggar) • [1] Strategy: evidence of working back from 11.30am • [2] Communication: choose the correct bus	 • [1] evidence • [2] 0853 from Biggar	2

F

Main Grid

4. Seonaid is saving up to buy a tablet computer costing £388.

She earns £7·30 per hour and works for 30 hours each week.

Seonaid is paid at the end of each week.

She pays £5·32 in Income Tax and £7·68 in National Insurance each week.

Her living expenses are £86 per week.

Seonaid saves **half** of the money that she has left each week towards the tablet computer.

How many weeks will it take her to save up enough money to buy the computer? 3

F

Main Grid

4.			Ans: 7 weeks		3
			• [1] Strategy: knows how to find left over money	• [1] (7·30 × 30) − (5·32 + 7·68 + 86)	
			• [2] Process: finds left over money	• [2] 120	
			• [3] Process/Communication: find number of weeks, rounded appropriately	• [3] (388 ÷ 60 = 6·46...) → 7 weeks	

F

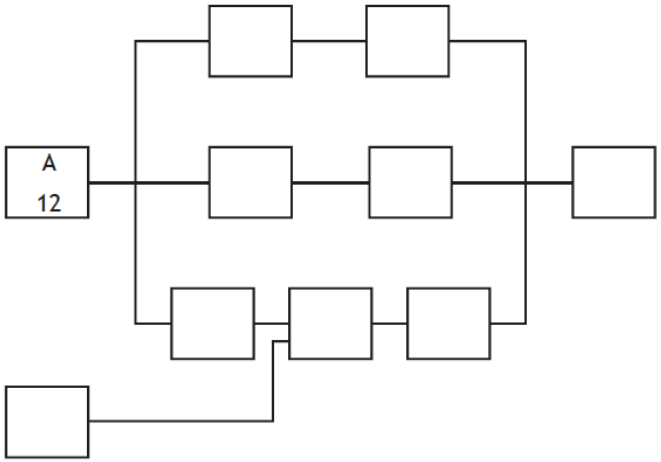
Main Grid

5. A computer company is researching how long it would take to develop a new games console and bring it to market.

The following table of necessary tasks was produced.

Activity	Description	Preceding Task	Time (months)
A	Product design	None	12
B	Market research	None	2
C	Production analysis	A	3
D	Product model	A	4
E	Sales brochure	A	1
F	Product testing	D	5
G	Cost analysis	C	3
H	Sales training	B,E	2
I	Pricing	H	1
J	Project report	F,G,I	1

(a) Complete the diagram below to show the tasks and times in the boxes.
(An additional diagram, if required, can be found on *Page 12*). **2**

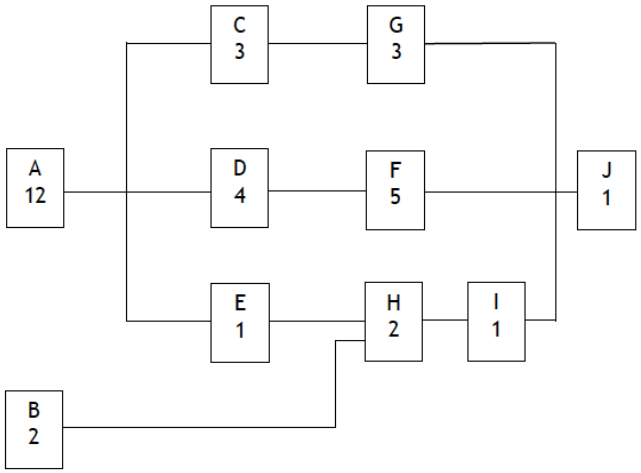


F

(b) The company want this entire process to be completed in 2 years.
Based on the times given, is this possible?
Show working to justify your answer. **2**

Main Grid

5.	(a)	Ans: task letters and times inserted correctly •[1] Strategy: start to allocate tasks •[2] Strategy: complete allocation of tasks	•[1] any 5 boxes •[2] remaining 4 boxes	2

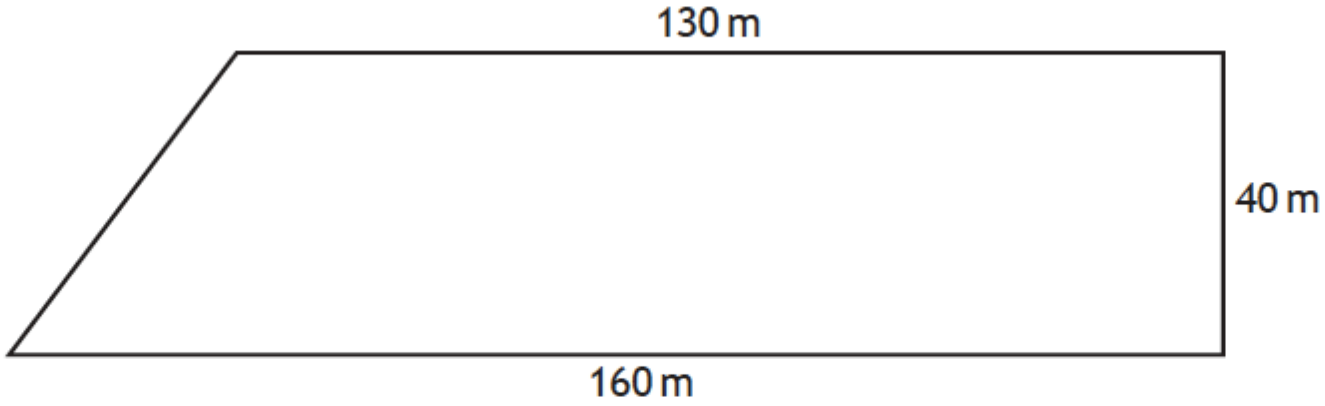


	(b)	Ans: Yes supported with working •[1] Strategy: select critical path •[2] Communication: yes as it only takes 22 months	•[1] 12 + 4 + 5 + 1 •[2] yes, it takes 22 months	2

F

Main Grid

6. A farmer needs to **completely enclose** this field with a new fence.



The fence is only sold in 80 metre rolls.

Each roll costs £73·99.

Calculate the cost of the new fence. 5

F

Main Grid

6.			**Ans: (£)369·95**		**5**
			• [1] Strategy: use correct form of Pythagoras Theorem including 30	• [1] $x^2 = 30^2 + 40^2$	
			• [2] Process: correct length of 4th side	• [2] $\sqrt{2500} = 50$	
			• [3] Strategy: know how to calculate number of rolls	• [3] (50 + 130 + 40 + 160) ÷ 80	
			• [4] Process/Communication: correctly rounded answer	• [4] 4·75 = 5 rolls	
			• [5] Process: calculate cost	• [5] $5 \times 73{\cdot}99 = 369{\cdot}95$	

F

Main Grid

7. The table below shows the vehicle tax to be paid on different vehicles.

The amount of vehicle tax paid depends on the CO_2 emissions of the vehicle and the fuel type.

Standard Rates – The following table contains the rates of vehicle tax for already registered cars, based on CO_2 emissions and fuel type.

		Petrol Car (Tax Class 48) and Diesel Car (Tax Class 49)				
		Non Direct Debit		Direct Debit		
Bands	CO_2 emission figure (g/km)	12 months	Six months	Single 12 month payment	Total payable by 12 monthly instalments	Single six month payment
Band A	Up to 100	£0	–	–	–	–
Band B	101 to 110	£20	–	£20	£21	–
Band C	111 to 120	£30	–	£30	£31·50	–
Band D	121 to 130	£110	£60·50	£110	£115·50	£57·75
Band E	131 to 140	£130	£71·50	£130	£136·50	£68·25
Band F	141 to 150	£145	£79·75	£145	£152·25	£76·13
Band G	151 to 165	£180	£99	£180	£189	£94·50
Band H	166 to 175	£205	£112·75	£205	£215·25	£107·63
Band I	176 to 185	£225	£123·75	£225	£236·25	£118·13
Band J	186 to 200	£265	£145·75	£265	£278·25	£139·13
Band K	201 to 225	£290	£159·50	£290	£304·50	£152·25
Band L	226 to 255	£490	£269·50	£490	£514·50	£257·25
Band M	Over 255	£505	£277·75	£505	£530·25	£265·13

Tom buys a **petrol** car which has a CO_2 emission figure of 142 g/km.

Tom decides to pay his vehicle tax by direct debit in two single six month payments.

How much more expensive is this than a single 12 month payment by direct debit? **3**

F

Main Grid

7.			**Ans: (£)7·26**		**3**
			• [1] Strategy: pick correct band	• [1] band F (could be implied by subsequent working)	
			• [2] Communication: pick consistent values from table	• [2] 76·13 and 145	
			• [3] Process/Communication: conclusion	• [3] 2 × 76·13 − 145 = 7·26	

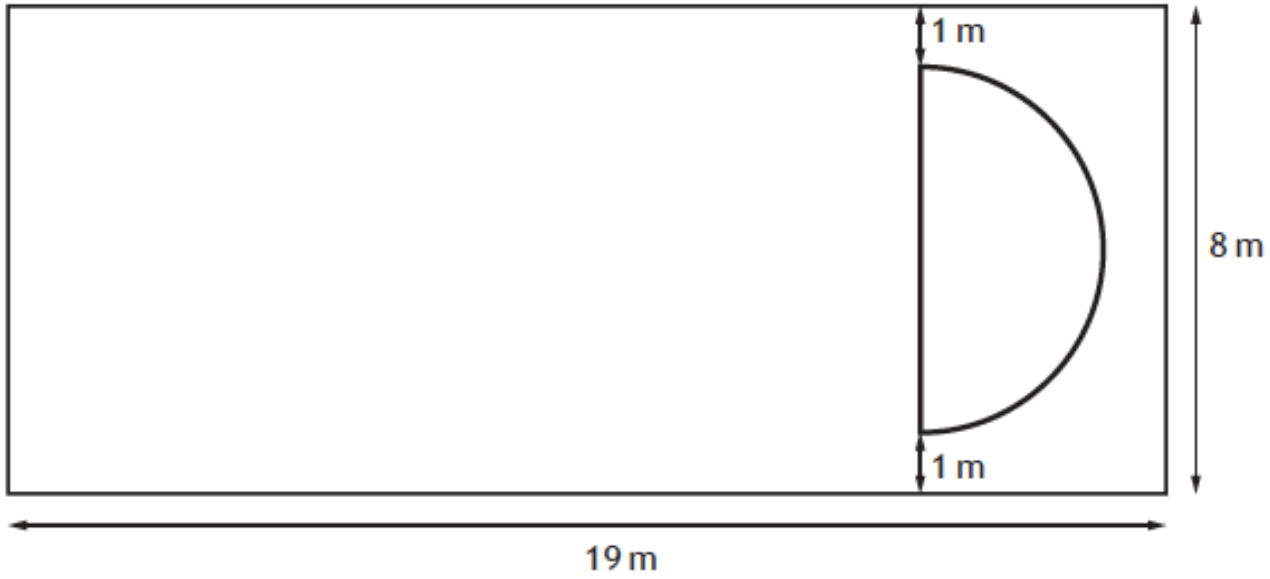
F

Main Grid

8. A new playground is planned for Aberbeath Primary School.

It will be a rectangle measuring 19 metres by 8 metres.

A semi-circular sandpit will be built within the playground as shown



The playground, excluding the sandpit, is to be covered in rubber tiles.

Calculate the area to be covered by the rubber tiles.

Take $\pi = 3{\cdot}14$.

Give your answer to **3 significant figures**. **4**

F

Main Grid

8.			**Ans: 138 m^2**		4
			•^{1} Strategy: rectangle – ½ circle	•^{1} evidence	
			•^{2} Process: find the area of the sandpit	•^{2} $\frac{1}{2}\times 3\cdot 14\times 3\times 3 = 14\cdot 13$	
			•^{3} Process: find area to be covered in rubber tiles	•^{3} 8 × 19 – 14·13 = 137·87	
			•^{4} Communication: round correctly **and** use appropriate units.	•^{4} 138 m^2	

F

Main Grid

9. A picture is glued onto a piece of card as shown.

- The picture is a rectangle with dimensions 4 cm by 5 cm.
- The rectangular card has an **area** 2·8 times greater than the **area** of the picture.
- One of the dimensions of the piece of card is 7 cm.

Calculate the other dimension of the piece of card. **3**

F

Main Grid

9.			**Ans: 8 (cm)**		3
			• [1] Strategy: knows how to use scale factor to find area of card	• [1] $4 \times 5 \times 2{\cdot}8$	
			• [2] Strategy: knows to divide scaled area of card by 7	• [2] ...÷ 7	
			• [3] Process: find missing length	• [3] 8 cm	

F

Main Grid

10. Bradley decides to cycle from Kilsyth to the highest point of Tak-Ma-Doon Road.

- The horizontal distance between these two places is 4·5 kilometres.
- Kilsyth is 70 metres above sea level.
- The highest point of Tak-Ma-Doon Road is 320 metres above sea level.

(a) Calculate the average gradient between Kilsyth and the highest point of Tak-Ma-Doon Road.

Give your answer as a fraction **in its simplest form.** **3**

(b) One part of the road has gradient $\frac{2}{25}$.

Is this steeper than the average gradient?

You must justify your answer. **2**

F

Main Grid

10.	(a)		**Ans: 1/18**		**3**
			• [1] Process: find the correct vertical difference	• [1] 250 (m)	
			• [2] Process: consistent units between the two values	• [2] 4·5 km = 4500 m or 250 m = 0·25 km	
			• [3] Strategy/Process: calculate gradient in its simplest form	• [3] 250/4500 = 1/18	
	(b)		**Ans: Yes, supported by working**		**2**
			• [1] Strategy: know how to compare gradients	• [1] Convert 1/18 to 2/36 **or** convert 2/25 to 1/12·5 **or** convert both fractions to 25/450 & 36/450	
			• [2] Communication: state conclusion consistent with working	• [2] Yes, 2/25 > 2/36	

F

Main Grid

1. The population of Scotland is recorded to the nearest hundred.

In 2014, the population was 5 347 600.

In 2015, the population was 5 369 000.

(a) Show that the percentage growth in population from 2014 to 2015 was 0·4%. **2**

(b) If the population continues to grow at the same rate, calculate the expected population in 2018.

Give your answer to the **nearest hundred**. **3**

F

Main Grid

1.	(a)		**Ans: proof**		**2**
			• [1] Strategy: know how to calculate percentage difference in population	• [1] $\frac{21400}{5347600} \times 100 = \ldots$	
			• [2] Process: calculate percentage growth	• [2] 0·4	
			Alternative Strategy:		
			• [1] Strategy: know to find 0·4% and add it on	• [1] Finding 0·4% of 5347600 and adding it on	
			• [2] Process: Calculate population in 2015 and round to the nearest hundred.	• [2] 5347600 ÷ 100 x 0·4 + 5347600 = 5369000	
	(b)		**Ans: 5 433 700**		**3**
			• [1] Strategy: identify multiplier	• [1] 1·004	
			• [2] Strategy: identify power	• [2] $\ldots^3$	
			• [3] Process/Communication: calculate population	• [3] 5 433 700	

F

Main Grid

2. Chris flew from Perth, Australia, to London, United Kingdom, on Saturday 9th January 2016.

- The plane left Perth, Australia, at 13:05.
- The total journey time, including a stopover in Dubai, is 20 hours and 25 minutes.
- Perth time is 8 hours ahead of London.

At what time did the plane land in London? **2**

F

Main Grid

2.			**Ans: 01:30 (on Sunday 10th)** • [1] Strategy: knows how to deal with time zone and flight time • [2] Process/Communication: state time	• [1] evidence of adding flight time and subtracting time difference • [2] 01:30 (on Sunday 10th)	**2**

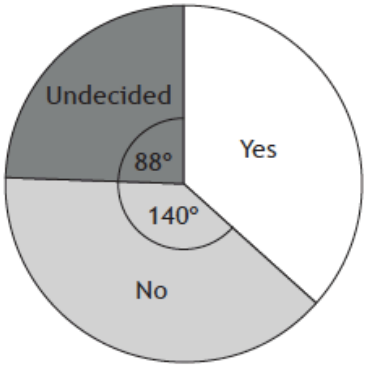
F

Main Grid

3. In September 2014 there was a referendum to determine the future of Scotland.

An opinion poll was taken in December 2013.
The question asked was "Should Scotland be an independent country?"

The results are shown in the pie chart below.



Another opinion poll was taken in April 2014.
1208 people were asked the same question as in December 2013.

The results of this poll are shown in the table below.

YES	NO	UNDECIDED
447	616	145

Compare the two opinion polls and make one relevant comment on the differences between them. **3**

F

Main Grid

3.			**Ans:** • [1] Strategy/Process: find any one of the three angles for the April poll. • [2] Strategy/Process: find the other two angles. • [3] Communication: make one valid comment.	• [1,2] Yes - 133° No - 184° Undecided - 43° • [3] eg similar proportion chose 'yes' in survey 2. larger proportion chose 'no' in survey 2. smaller proportion chose 'undecided' in survey 2.	**3**

F

Main Grid

4. Alison and Michael are travelling to Inverie on Knoydart for a holiday. They must take a ferry from Mallaig to Inverie

(a) The direct distance from Mallaig to Inverie is 9·8 kilometres.

(i) Calculate the scale used in the diagram above. **1**

(ii)

The ferry leaves Mallaig and travels North for 0·6 km .

The ferry then changes direction to sail directly to Inverie.

Use the second diagram to find the bearing and distance, in kilometres, that the ferry must travel on the **second part** of its journey.

(b) The average speed of the ferry from Mallaig to Inverie is 24 ± 3 kilometres per hour depending on tide and weather.

What is the shortest time that the **complete** ferry journey might take?

Give your answer to the **nearest minute**. **3**

F

Main Grid

4.	(a)	(i)	Ans: 1:100 000 •[1] Communication: find the scale	•[1] 1:100 000	1
		(ii)	Ans: 074°, 9·6 km •[2] Communication: correct bearing •[3] Communication: distance in kilometres	•[2] 074° •[3] 9·6 km	2
	(b)		Ans: 23 (minutes) •[1] Strategy: use correct speed •[2] Process: find time in hours to 3 decimal places •[3] Communication: find the time in minutes, and round	•[1] use 27 km/hr •[2] 10·2 ÷ 27 = 0·377... (hours) •[3] 0·377... × 60 = 22·66 ... →23	3

F

Main Grid

5. Fiona is planning to stay in New York, USA, for three days.
She researches the cost of various attractions.

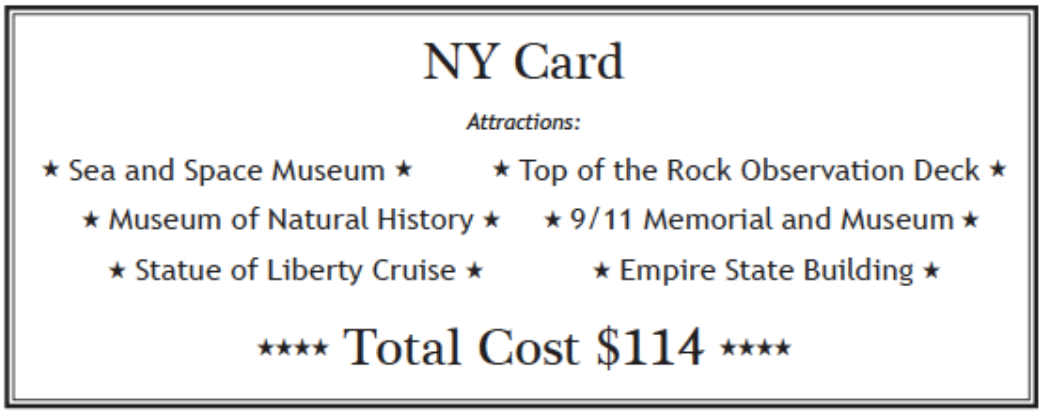
Attraction	Full price in US Dollars
Empire State Building	$32
Top of the Rock Observation Deck	$30
Statue of Liberty Cruise	$40
9/11 Memorial and Museum	$24
Waxworks	$37
One World Observatory	$32

Fiona will visit all six of these attractions while she is there.

Fiona plans to buy a discount card to reduce the cost of visiting these attractions.

Not all of the attractions are included in all of the cards. Fiona must pay full price for these.

Card 1: NY Card



Benefits:

These six attractions can be visited for a single payment of $114.
This card can only be used once per attraction.
It is valid for 30 days from first use.

F

Main Grid

Card 2: Explore NY Card

Explore NY Card

Attractions:

9/11 Memorial and Museum • Statue of Liberty Cruise
Museum of Natural History • Sea and Space Museum
Empire State Building • Top of the Rock Observation Deck
Waxworks • Carnegie Hall • Rockefeller Centre Tour

Cost for any 3 attractions $71

Benefits:

This card can be used for any 3 attractions from the list.
This card can only be used once per attraction.
It is valid for 30 days from first use.

Card 3: NY Town Pass

NY Town Pass

80+ attractions are included for one price.
When activated the card is valid for 1, 2, 3 or 5 days.
These must be consecutive days.

Cost	
$90 1 day pass	$180 3 day pass
$140 2 day pass	$190 5 day pass

Benefits:

All of Fiona's chosen attractions can be visited with this card.

(a) During her three-day visit, Fiona will visit two attractions each day.

Fiona is going to buy one discount card.

(i) Calculate the total cost of all six attractions if Fiona buys Card 1. **2**

(ii) Calculate the cheapest price that Fiona could pay for entry to her six chosen attractions. **4**

(b) Fiona pays the cheapest price for entry to her six chosen attractions.

She pays before leaving the UK.

The cost is £100·96.

Calculate the exchange rate that Fiona received.

Give your answer correct to **3 decimal places**. **2**

F

Main Grid

5.	(a)	(i)	Ans: ($)183		2
			•[1] Strategy: identify the costs not included	•[1] $32 and $37	
			•[2] Process: calculate the cost for card 1	•[2] $114 + 32 + 37 = $183	
		(ii)	Ans: $157 supported by working		4
			•[3] Strategy: identify the "missing" attraction and the two cheapest attractions	•[3] $24, $32 and $30	
			•[4] Process: calculate the cost for card 2	•[4] $71 + $24 + $32 + $30 = $157	
			•[5] Process: state cost of card 3	•[5] $180	
			•[6] Communication: state the cheapest price	•[6] ($)157	
	(b)		Ans: £1 gives $1·555 or $1 gives £0·643		2
			•[1] Strategy: evidence of knowing to divide	•[1] 157 ÷ 100·96 or 100·96 ÷ 157	
			•[2] Process: state rounded answer	•[2] £1 gives $1·555 or $1 gives £0·643	

F

Main Grid

6. Fraser tests motorcycle tyres on racing circuits.

On Monday he tested Goodhold tyres.

His lap times, in seconds, are given below.

81·8 81·7 81·6 81·0 80·3 80·2

(a) For Fraser's times on Goodhold tyres, calculate:

(i) the mean; **1**

(ii) the standard deviation. **3**

(b) Fraser then changed to Megagrip tyres and recorded his times for another six laps.

These times produced a mean of 81·6 seconds and standard deviation of 0·65 seconds.

Make two valid comments comparing the two types of tyres. **2**

(c) Another rider completed one lap of the circuit in 81·0 seconds.

The track is 3·6 kilometres long.

Calculate his average speed in **kilometres per hour**. **3**

F

Main Grid

6.	(a)	(i)	**Ans: 81·1** •[1] Process: calculate mean	•[1] (81·8 + 81·7 + 81·6 + 81·0 + 80·3 + 80·2) ÷ 6 = 81·1	1
		(ii)	**Ans: 0·72** •[2] Process: calculate $(x-\bar{x})^2$ •[3] Strategy: substitute into formula •[4] Process: calculate standard deviation	•[2] 0·49, 0·36, 0·25, 0·01, 0·64, 0·81 •[3] $\sqrt{(2\cdot56\div5)}$ •[4] 0·72	3
	(b)		**Ans: two valid comments** •[1] Communication: comment regarding the mean •[2] Communication: comment regarding standard deviation	•[1] eg on average Goodhold give a faster lap time •[2] eg lap times with Goodhold are less consistent	2
(c)			**Ans: 160 (km/hr)** •[1] Strategy: correct substitution into S = D/T •[2] Strategy: know how to change km/sec to km/hr •[3] Process: find speed in km/hr	•[1] S = 3·6/81 •[2] ...× 60 × 60 •[3] 160	3
			Alternative Strategy •[1] Strategy: knows how to find the time in hours •[2] Strategy: consistent substitution into S = D/T •[3] Process: find speed in km/hr	•[1] 81 ÷ 60 ÷ 60 •[2] 3·6 ÷ ... •[3] 160	3

F

Main Grid

7. Grace works for a company selling fitted kitchens.

She is paid a basic monthly salary of £500.

She also receives 5% commission on all her sales **above** £8000.

In January Grace sells £23 000 of goods.

Her monthly deductions are 12% of her gross income.

Grace writes down her budget for the month.

Rent	£245
Bills	£198
Food	£164
Entertaining	£75

Grace saves any surplus.

(a) Calculate Grace's **net** pay for January. **4**

(b) (i) Calculate the surplus that Grace will have for January. **1**

(ii) Grace's rent increases to £260 per month.

Calculate the percentage increase in her rent. **2**

F

*Question Continues On Following Slide

Main Grid

(c) To buy a car Grace needs to borrow £4500.

She wants to repay the loan **as soon as possible**.

She investigates the cost of the loan from five different lenders.

The table shows the repayments for a £4500 loan.

Lender	12 months	24 months	36 months
Tasko	£413·86	£215·07	£150·60
Bank of Shapes	£418·54	£219·31	£157·42
TMS	£458·83	£260·59	£197·74
Premier Bank	£422·46	£214·74	£159·21
Free Bank	£432·99	£234·15	£170·09

Grace assumes that she will earn the same commission each month.

Calculate her **new monthly surplus** and determine from which lender she should take her loan, and over how many months. **2**

F

Main Grid

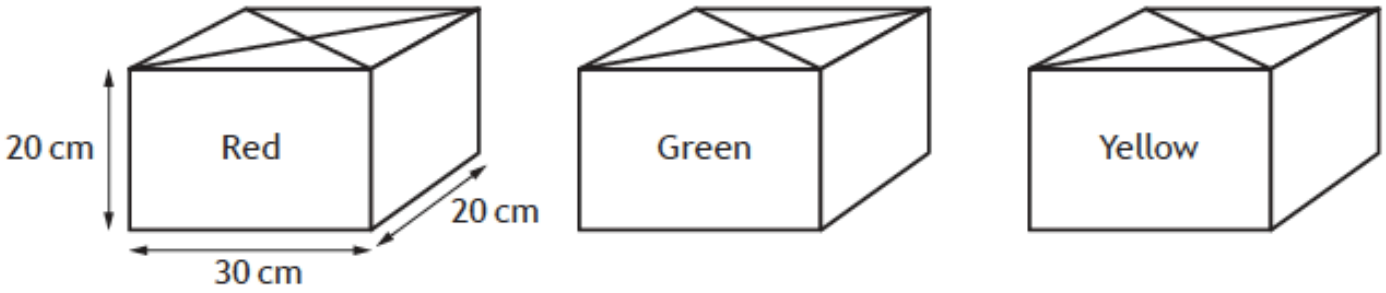
7.	(a)		Ans: (£)1100 •[1] Process: calculate 5% of £15,000 •[2] Communicate: find gross pay •[3] Process :calculate 12% of £1250 •[4] Communicate: find net pay	•[1] £750 •[2] 750 + 500 = £1250 •[3] 12% of 1250 = £150 •[4] 1250 − 150 = 1100	4
	(b)	(i)	Ans: (£) 418 •[1] Process: net pay - monthly bills	•[1] 1100 − 682 = 418	1
		(ii)	Ans: 6·1(%) •[2] Strategy: know how to find percentage increase •[3] Process: calculate percentage increase	•[2] 15 ÷ 245 × 100 •[3] 6·1	2
	(c)		Ans: Premier bank, 24 months •[1] Process: find the new monthly surplus •[2] Communicate: correct choice of lender	•[1] 403 •[2] Premier Bank, 24 months	2

F

Main Grid

8. Brendan makes candles from blocks of wax.

Each block of wax is a cuboid measuring 30 cm by 20 cm by 20 cm as shown.



Each candle contains the colours red, green and yellow in the ratio 3 : 1 : 2 respectively.

Each candle is a cube with volume 729 cm^3.

(a) Brendan only has 1 block of each colour.
What is the maximum number of candles that he can make? **3**

Brendan makes the maximum number of candles.
Any wax that is left over is thrown away.

Each block of wax costs £13·75.
Brendan also buys wicks which cost 18p per candle.

Brendan adds 65% to his costs when calculating the selling price of each candle.

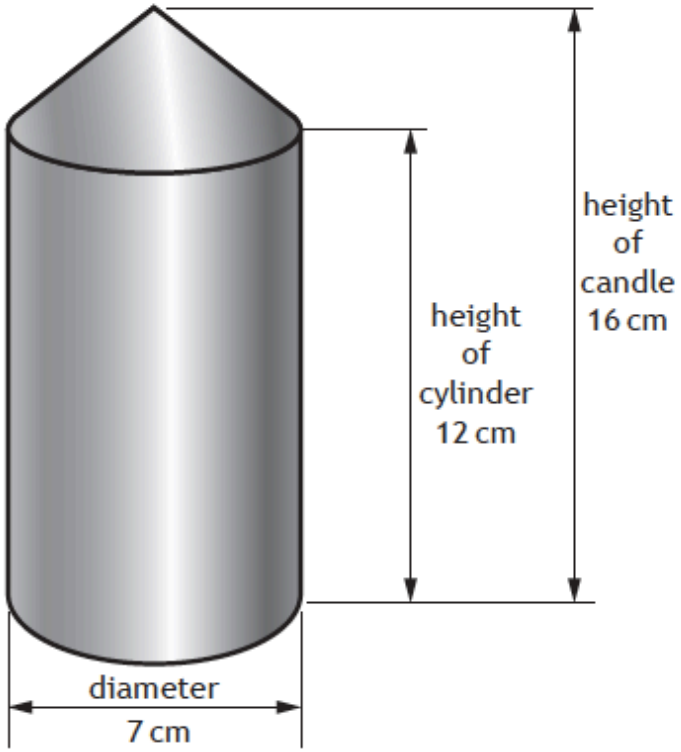
(b) What is Brendan's selling price for each candle? **3**

F

*Question Continues On Following Slide

Main Grid

Brendan also makes blue candles in the shape of a cylinder with a cone on top as shown.



(c) He buys blue wax in blocks with volume 12 000 cm^3.

Brendan thinks that he can make 25 of these candles from one block of wax.

Is he correct?

Use your working to justify your answer. **7**

F

Main Grid

8. (a)

Ans: 32 candles

•[1] Strategy: know how to use ratio	•[1] evidence of knowing how to scale up the ratio
•[2] Process: find total amount of wax used	•[2] 12000 + 4000 + 8000 =24000 cm^3
•[3] Process: find number of candles	•[3] 24000 ÷ 729 = 32·92... = 32

Alternative Strategy:

•[1] Strategy: know how to use ratio	•[1] evidence of 3/6 of 729
•[2] Process: finds volume of red wax available and volume of red wax in candle	•[2] 12000cm^3 & 364·5
•[3] Process: find number of candles	•[3] 12000 ÷ 364·5 = 32·92 rounded to 32

3

(b)

Ans: (£)2·43 or 2·42

•[1] Process:find cost of wax plus wicks	•[1] 3 × 13·75 + 32 × 0·18 = 47·01
•[2] Process: add 65%	•[2] 47·01 × 1·65 = 77·57
•[3] Process: find selling price of 1 candle	•[3] 77·57 ÷ 32 = 2·424... = 2·43

3

(c)

Ans: no supported by working

•[1] Strategy: knows how to find compound volume	•[1] evidence
•[2] Strategy: substitute into cylinder formula	•[2] V = π × 3·5 × 3·5 × 12
•[3] Process: find volume of cylinder	•[3] 461·8 (or 461·58)
•[4] Strategy: substitute into cone formula	•[4] $V = \frac{1}{3} \times 3{\cdot}5 \times 3{\cdot}5 \times 4$
•[5] Process: find volume of cone	•[5] 51·3
•[6] Process: find the number of candles that can be made	•[6] 461·8 + 51·3 = 513·1, 12000 ÷ 513·1 = 23·38
•[7] Communication: valid conclusion	•[7] no he can't make 25 candles

7

F

Main Grid

1. A wall is built using foam bricks which are 194 ± 2 mm long.

The wall is 50 bricks long.

What is the minimum length of the wall? **2**

F

Main Grid

1.			Ans: 9600 (mm) • [1] Strategy: know to calculate minimum length of brick x 50 • [2] Process/communication: answer	• [1] (194 - 2) × 50 • [2] 9600	2

F

Main Grid

2. Anna works as a sales person for a computer company.

She is paid a basic monthly salary of £2450 plus commission of 2·5% on her monthly sales over £3000.

(a) Calculate Anna's gross salary for April when her sales totalled £9000. **3**

In her April payslip, she has the following deductions:

- Income Tax £334·67
- National Insurance £230·20
- Pension £164·74

(b) Calculate her net salary for April. **2**

F

Main Grid

2.	(a)		Ans: (£)2600 • [1] Strategy: know to calculate 2·5% of £6000 • [2] Process: calculate 2·5% of £6000 • [3] Strategy/process: add commission to basic salary	 • [1] evidence • [2] 150 • [3] 2600	3
2.	(b)		Ans: (£)1870·39 • [1] Strategy: attempt to calculate gross pay - total deductions • [2] Process: calculate net pay	 • [1] evidence • [2] 1870·39	2

F

Main Grid

3. Scott is a farmer.

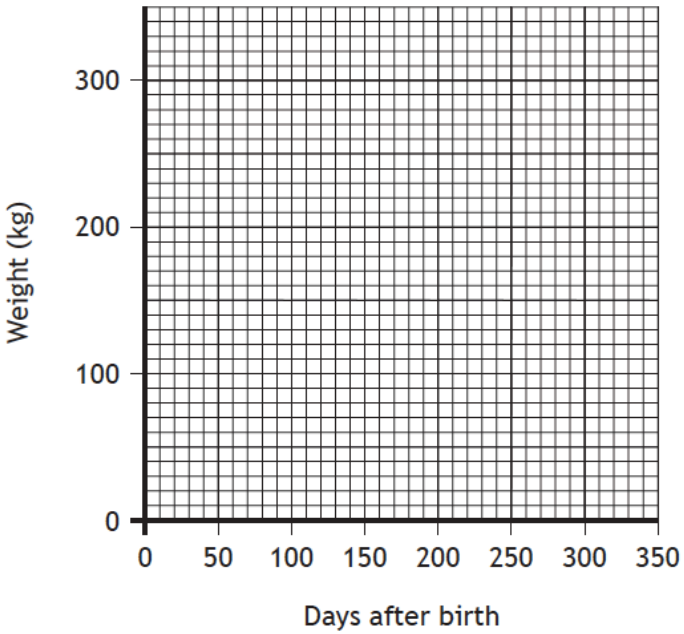
He records the weight of a calf from birth.

The weight of his calf is shown in the table below.

Days after birth	0	60	120	160	200	260
Weight (kg)	40	110	130	175	220	275

(a) On the grid below draw a scatter graph to show this data. **2**

(An additional grid, if required, can be found on *Page 14*.)



(b) Draw a line of best fit on the diagram above. **1**

(c) Use your line of best fit to estimate the age of this calf in days when it weighed 240 kilograms. **1**

F

Main Grid

3.	(a)		**Ans: Points plotted correctly** • [1] Communication: 4 points correct • [2] Communication: all 6 points correct					**2**

D	0	60	120	160	200	260
W	40	110	130	175	220	275

(b)		**Ans: Line of best fit** • [1] Strategy: consistent line of best fit	• [1]		**1**
(c)		**Ans: (days)** • [1] Communication: answer consistent with line of best fit	• [1]		**1**

F

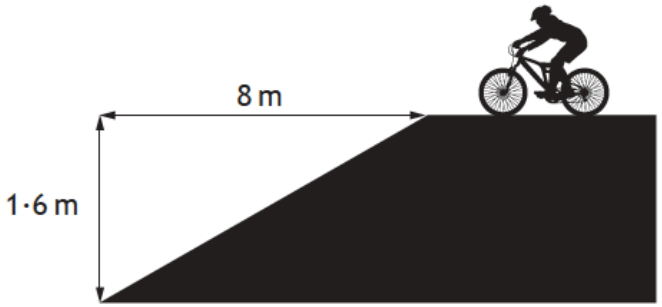
Main Grid

4. When classifying mountain bike trails, the gradient of the steepest section is taken into account.

Colour Grade (Difficulty)	Maximum Gradient
Green (Easy)	$\frac{1}{10}$
Blue (Intermediate)	$\frac{3}{20}$
Red (Advanced)	$\frac{1}{4}$
Black (Severe)	$\frac{1}{2}$

A new trail has been built at a mountain bike centre.

The steepest section of the new trail is shown below.



Can this be classified as a blue trail? 3

Use your working to justify your answer.

F

Main Grid

4.			**Ans: No, supported by working.**		3
			• [1] Strategy: know how to calculate gradient	• [1] 1·6/8	
			• [2] Process: know how to compare gradients of new trail and blue trail	• [2] 4/20 (3/20 does not need to be explicitly stated) or 8/40 and 6/40 or 0·2 and 0·15 or equivalent	
			• [3] Strategy/ communication: consider the blue gradient and consistent conclusion	• [3] No, supported by working	

F

Main Grid

5. Jane is trying to improve the number of pull ups she can do.

She looks online for pull up assistance bands.

Jane finds a table explaining which type of bands she should use based on her weight and the number of unassisted pull ups she can do.

The table is shown below.

	Body Weight (pounds)					
Unassisted pull ups	*90–120*	*121–150*	*151–200*	*201–250*	*251–300*	*300+*
0–4	D	D and A	E	F	F	G and A
5–8	C and A	D	E	E	E and B	G
9–11	C	D	D and C	E	E and A	F
12–15	C	C and B	D and B	D and C	E	E and C
16–20	B	C	D	D and B	E	E

Jane weighs herself. She is 10 stone and 1 pound.

1 stone = 14 pounds

Jane can do 3 unassisted pull ups.

(a) Which band(s) does the table recommend that Jane should buy? **1**

F

*Question Continues On Following Slide

Main Grid

Jane's personal trainer, Lynn, wants to buy one of each band A to G.

The recommended retail prices (RRP) of the bands are shown in the table below.

Band	Colour	RRP
A	Yellow	£2·50
B	Red	£3·90
C	Black	£8·95
D	Purple	£10·95
E	Green	£14·00
F	Blue	£17·00
G	Orange	£18·50

To buy all of the bands individually, the total RRP would be £75·80.

Lynn considers the following special offers.

Shop 1

Shop 2

Shop 3

(b) Which shop offers the cheapest option for buying one of each band? 3

Use your working to justify your answer.

F

Main Grid

5.	(a)		**Ans: Bands D and A** • [1] Communication: state bands required	• [1] $10 \times 14 + 1 = 141$, she needs bands D and A	**1**
	(b)		**Ans: Shop 2** • [1] Process: calculate cost for shop 1 • [2] Process: calculate cost for shop 2 • [3] Communication: conclusion consistent with working	• [1] 49·50 • [2] 45·48 • [3] Shop 2	**3**

F

Main Grid

6. The mathematics teachers in a school win a lottery.

They decide to share their winnings **in proportion to** the amount they each pay per week.

They each pay the following amounts per week:

Mr Jones	£0·50
Miss Smith	£2·00
Mr Ross	£2·50
Mr Young	£4·00

Mr Young's share is £2 794 000.

Calculate how much the teachers win in total. 3

F

Main Grid

6.			Ans: (£)6 286 500 • [1] Strategy/process: calculate one(£1)share • [2] Process: calculate total number of shares • [3] Process: calculate total amount	• [1] 2 794 000 ÷ 4 = 698 500 • [2] 2·50 + 2·00 + 4·00 + 0·50 = 9 • [3] 9 × 698 500 = 6 286 500	3

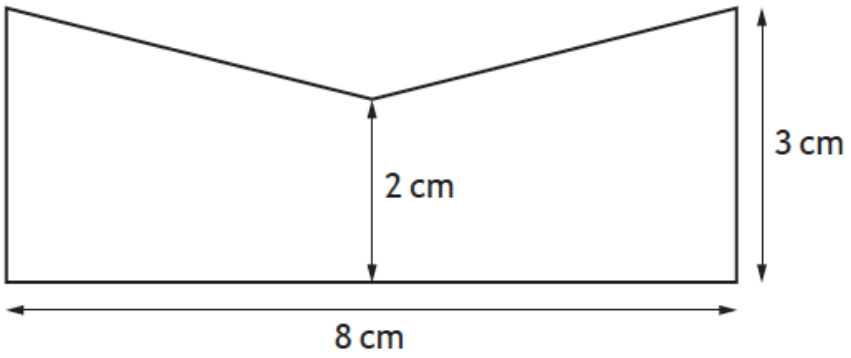
F

Main Grid

7. Aneesa makes enamelled badges.

Each badge is made from metal.

The shape of the badge is shown below.



(a) Calculate the area of the front of each badge. **2**

The front of each badge is covered with enamel.

The enamel that Aneesa buys costs £90 for one pack.

One pack will cover 180 cm^2.

She makes as many badges as possible from one pack.

The metal that she uses costs £3 for each badge.

To make a profit, Aneesa adds an extra £17 to the cost of each badge.

(b) Calculate her selling price for each badge. **3**

F

Main Grid

7.	(a)		Ans: 20 (cm^2)		2
			• [1] Strategy: know how to calculate composite area	• [1] Evidence of any valid strategy	
			• [2] Process: calculate area	• [2] eg $24-4=20$	
	(b)		Ans: (£)30		3
			• [1] Process: calculate the number of badges per pack	• [1] 180 ÷ 20 = 9	
			• [2] Process: calculate the cost of enamel for 1 badge	• [2] 90 ÷9 = 10	
			• [3] Process: calculate selling price	• [3] 10 + 3 + 17 = 30	

F

Main Grid

8. Natalie is donating blood.

Whilst donating blood she notices a chart.

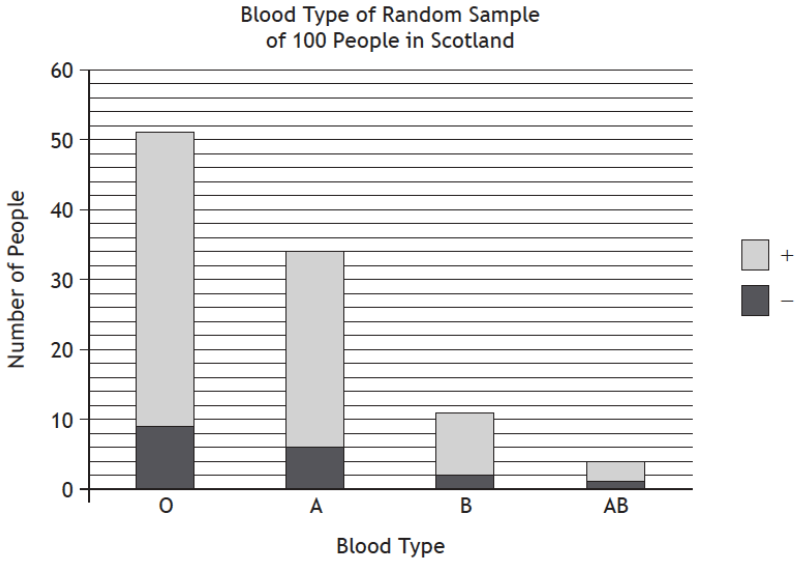
The chart states that not every blood type can be given to every patient.

The table shows which patients each blood type can help.

Blood type can be either positive (+) or negative (–).

Donor's Blood Type

Patient's Blood Type	O–	O+	B–	B+	A–	A+	AB–	AB+
AB+	✓	✓	✓	✓	✓	✓	✓	✓
AB–	✓		✓		✓		✓	
A+	✓	✓			✓	✓		
A–	✓				✓			
B+	✓	✓	✓	✓				
B–	✓		✓					
O+	✓	✓						
O–	✓							



Natalie's blood type is B+.

What fraction of the people sampled could safely be given Natalie's blood? 3

F

Main Grid

8.		Ans: $\frac{12}{100}\left(=\frac{3}{25}\right)$		3
		• [1] Strategy: evidence of identifying the blood groups that B+ can help	• [1] eg AB+ and B+	
		• [2] Communication: interpret stacked bar chart	• [2] 3 people AB+ and 9 people B+	
		• [3] Process: calculate fraction	• [3] $\frac{3+9}{100}=\frac{12}{100}\left(=\frac{3}{25}\right)$	

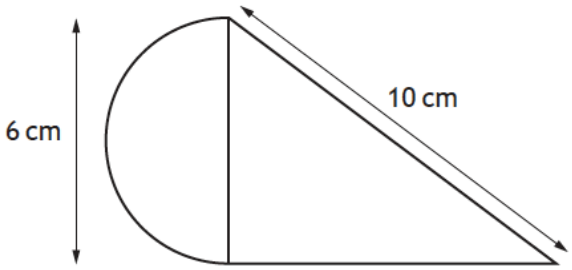
F

Main Grid

9. A new design is discussed for a glue dispenser.

It is to be made from two plates of plastic.

Each plate is in the shape of a right angled triangle and a semi-circle as shown.

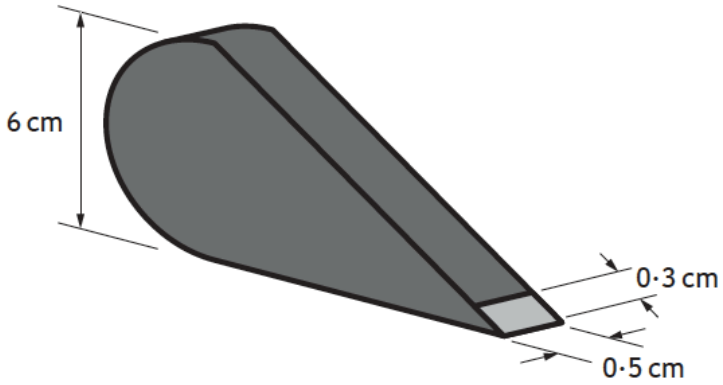


(a) Calculate the perimeter of each plate. 4

Use $\pi = 3{\cdot}14$.

A rectangular piece of plastic 0·5 cm wide is bent and wrapped around the perimeter of the two plates to join them together.

The rectangular piece of plastic will be 0·3 cm shorter than the perimeter of the shape to allow the glue to flow.



(b) Calculate the area of the **rectangular** piece of plastic required to hold the plates together. 2

F

Main Grid

9.	(a)		**Ans: 27·42 (cm)**		**4**
			$\bullet^1$ Strategy: correct substitution in Pythagoras' Theorem	$\bullet^1$ eg $10^2 - 6^2$	
			$\bullet^2$ Process: calculate the missing side	$\bullet^2$ $x = 8$	
			$\bullet^3$ Process: calculate length of the semi-circle	$\bullet^3$ 3·14 x 6 ÷ 2 = 9·42	
			$\bullet^4$ Process: calculate the perimeter of the shape	$\bullet^4$ 10 + 8 + 9·42 = 27·42	
9.	(b)		**Ans: 13·56 (cm^2)**		**2**
			$\bullet^1$ Strategy: know how to calculate area of rectangular strip	$\bullet^1$ evidence	
			$\bullet^2$ Process: calculate the area of the strip	$\bullet^2$ $(27{\cdot}42 - 0{\cdot}3) \times \frac{1}{2} = 13{\cdot}56$	

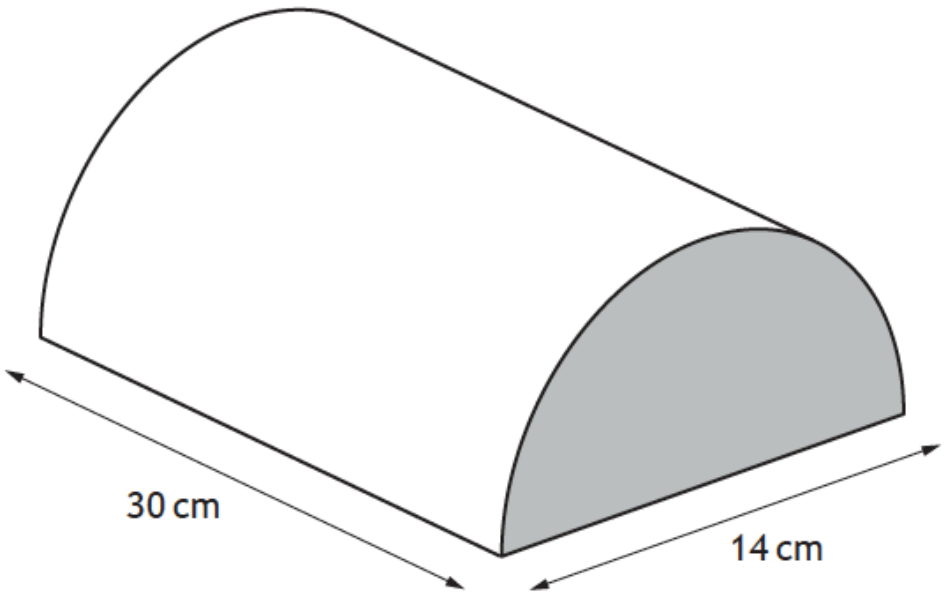
F

Main Grid

1. The Victorians used stoneware hot water bottles.

They were semi-circular prisms as shown.

The diameter of the bottle is 14 cm and the length is 30 cm.



Calculate the volume of the hot water bottle. 3

F

Main Grid

1.			**Ans: 2309 cm^3 or 2309 ml or 2·309 l**		**3**
			• [1] Strategy: know how to calculate the volume of half a cylinder	• [1] evidence	
			• [2] Strategy: substitute into formula	• [2] $\frac{1}{2}\times\pi\times7^2\times30$	
			• [3] Process: calculate the volume and state units	• [3] 2309·07…cm^3	

F

Main Grid

2. Asif bought 8000 shares in a local company in April 2013.

Each share cost him 73 pence.

The value of the shares

- decreased by 3% in the first year then,
- increased by 4·2% in each of the next **two years.**

(a) How much were Asif's shares worth in total in April 2016? **5**

In April 2017 Asif's shares were worth £6560 in total.

He decided to sell 5000 of his shares.

He was charged £12·95 commission on his sale.

(b) How much did he receive from the sale of the shares? **2**

F

Main Grid

2.	(a)		**Ans: (£)6150·64** •[1] Process: work out the cost of 8000 shares •[2] Strategy: know how to calculate percentage decrease •[3] Strategy: know how to calculate percentage increase •[4] Strategy: identify power •[5] Process: calculate the value of the shares	•[1] 8000 × 0·73 = 5840 •[2] Evidence of 0·97 •[3] Evidence of 1·042 •[4] ...[2] •[5] 6150·64	**5**
2.	(b)		**Ans: (£)4087·05** •[1] Strategy: know to calculate $\frac{5}{8}$ of 6560 and subtract commission •[2] Process: calculate amount received	•[1] evidence •[2] 4087·05	**2**

F

Main Grid

3. Kyle is buying a new three piece suite.

It is advertised at a price of £1260.

Kyle can't afford to pay this all at once.

He decides to use a payment plan to buy the three piece suite.

The **total price** of the payment plan is **12% more** than the advertised price.

The payments are calculated as follows:

- deposit of $\frac{1}{3}$ of the total price
- 8 equal monthly instalments
- final payment of £200.

How much will each monthly instalment be?

4

Main Grid

3.			**Ans: (£)92·60**		**4**
			•[1] Process: calculate new price	•[1] 1260+151·20 = 1411·20	
			•[2] Process: calculate the deposit	•[2] $\frac{1}{3}$ of 1411·20 = 470·40	
			•[3] Process: calculate amount still payable	•[3] 470·40+200=670·40 1411·20-670·40 = 740·80	
			•[4] Communication: state how much each monthly payment is	•[4] 740·80÷8= 92·60	

F

Main Grid

4. The back to back stem and leaf diagram shows data gathered at a gymnasium before and after walking on a treadmill.

Heart rate data (beats per minute (bpm))

Before						After					
		9	8	3	2	0	5 | 9					
6	6	6	1	1	0	0	6 | 2	4	7	8	8
				9	6	2	7 | 1	1	1	8	
							8 | 2	4	9		
							9 | 2	5			

7 | 8 = 78

n = 15 **n = 15**

(a) State the most common heart rate (bpm) **after** walking on the treadmill. **1**

(b) What is the difference in the median heart rates (bpm) before and after walking on the treadmill? **2**

(c) Construct a boxplot to show the heart rate data **after** exercise.

F

Main Grid

4.	(a)		**Ans: 71** •[1] Communication: calculate the most common heart rate	•[1] 71	1
	(b)		**Ans: 10** •[1] Communication: calculate either median •[2] Communication/process: calculate other median and difference	•[1] 61 or 71 •[2] calculate other median and difference $71-61=10$	2
	(c)		**Ans: correct boxplot** •[1] Process: calculate lower quartile •[2] Process: calculate upper quartile •[3] Communication: correct end points drawn •[4] Communication: consistent box drawn	•[1] $Q_1 = 67$ •[2] $Q_3 = 84$ •[3] 59 and 95 •[4] Box showing Q_1, Q_2 and Q_3	4

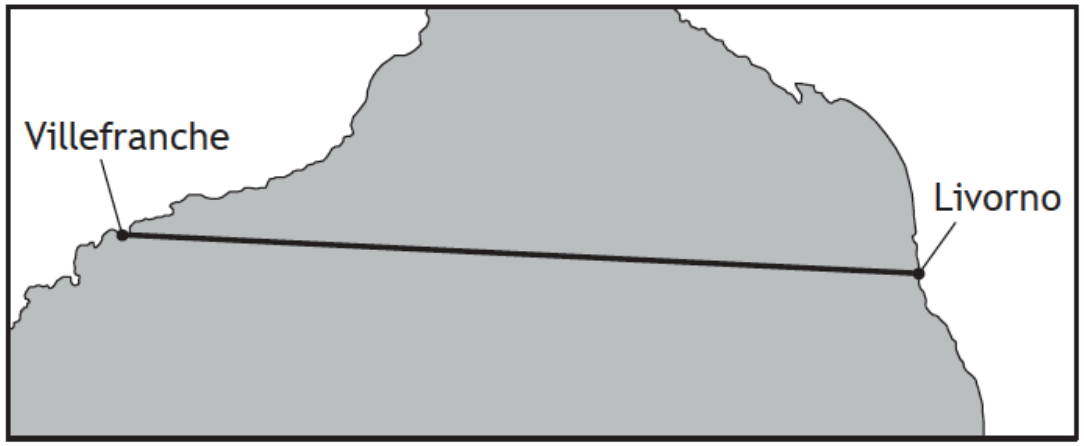
F

Main Grid

5. Mr and Mrs Sibbald went on a cruise.

Part of the cruise involved sailing from Villefranche to Livorno.

The map below shows the route the ship takes.



The scale of the map is 1 : 3 000 000

(a) Calculate the distance from Villefranche to Livorno. **2**

Give your answer in kilometres.

F

Main Grid

5.	(a)		**Ans: 240(km)**		**2**
			• [1] Process: calculate the distance from a scale drawing	• [1] $8 \times 3000000 = 24000000$	
			• [2] Process/communication: give answer in kilometres	• [2] $24000000 \div 100 \div 1000 = 240$	

F

Main Grid

It took 7 hours and 30 minutes to sail from Villefranche to Livorno.

(b) Calculate the average speed of the ship's journey. **3**

Give your answer in knots.

1 kilometre per hour = 0·54 knots

Round your answer to 2 significant figures.

F

Main Grid

(b)		**Ans: 17 (knots)**		**3**
		•[1] Strategy: know how to calculate average speed and to change hours and minutes to hours	•[1] $\frac{240}{7 \cdot 5} = \ldots$	
		•[2] Strategy: know how to convert average speed into knots	•[2] … ×0·54 = …	
		•[3] Process/communication: calculate average speed to **2 significant figures**	•[3] 17·28 = 17 (2 sig fig)	

F

Mr and Mrs Sibbald took £2400 spending money.

They exchanged 55% of their money into euro, to spend ashore.

The exchange rate was **£1 = 1·15 euro.**

By the end of the cruise they had spent 1379 euro.

(c) Calculate how many euro they had left at the end of the cruise. 2

F

Main Grid

5.	(c)		**Ans: 139 (euro)**		**2**
			• [1] Strategy: know how to calculate amount of euro	• [1] 55% of 2400×1·15...	
			• [2] Process: calculate remaining euro	• [2] $1518 - 1379 = 139$	

F

Main Grid

Mr and Mrs Sibbald take part in an on board lottery which consists of a draw from a set of 32 balls numbered from 1 to 32.

(d) (i) What is the probability that the first ball drawn has a number greater than 25? **1**

In the draw four numbered balls are drawn and not replaced.

A further bonus ball is also drawn.

(ii) What is the probability of the number 9 being drawn as the bonus ball if it was not drawn in the first four? **2**

F

Main Grid

(d)	(i)	**Ans: 7/32** • [1] Communication: state probability	• [1] 7/32	**1**
	(ii)	**Ans: 1/28** • [2] Strategy/process: calculate denominator • [3] Communication: state probability	• [2] denominator of 28 • [3] 1/28	**2**

F

Main Grid

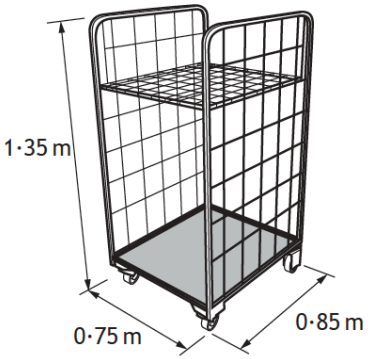
6. Russell is a lorry driver for a mail delivery company.

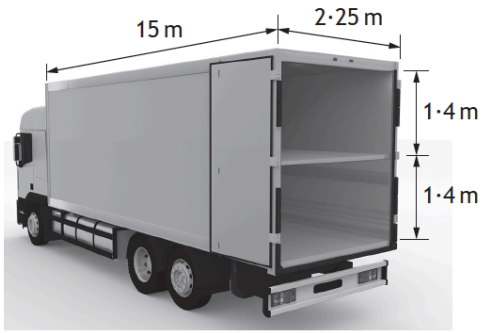
The mail is packed into cages which are then loaded on to the lorry.

His lorry has two levels for fitting cages.

Each cage has wheels on the bottom and must always be **loaded upright**.

The dimensions of the cage and the internal dimensions of the back of the lorry are shown in the diagrams.





(a) What is the maximum number of cages that can be loaded into the back of the lorry? **3**

Russell works night shift.

- He works from 2300 until 0900 the next day.
- His rate of pay is £14·40 per hour.
- He gets paid time and a half between 2200 and 0730.
- He works 5 shifts each week.

(b) Calculate his weekly gross pay. **3**

F

Main Grid

6.	(a)		**Ans: 102 (cages)**		**3**
			•[1] Strategy: know to calculate two arrangements	•[1] Evidence	
			•[2] Process: calculate one arrangement.	•[2] 2·25m ÷ 0·75 = 3 cages 15m ÷ 0·85 = 17 cages Total = 3 x 17 × 2 = 102 cages	
			•[3] Process/communication: calculate second arrangement and make consistent conclusion	•[3] 2·25m ÷ 0·85 = 2 cages 15m ÷ 0·75 = 20 cages exactly Total = 20 x 2 ×2 = 80	
6.	(b)		**Ans: (£) 1026**		**3**
			•[1] Process: calculate basic pay	•[1] $1\frac{1}{2} \times 14 \cdot 40 = 21 \cdot 60$	
			•[2] Process: calculate overtime Pay	•[2] $8\frac{1}{2}$ x 14·40 x 1·5 = 183·60	
			•[3] Process: calculate weekly gross pay	•[3] (183·60 + 21·60) × 5 = 205·20 × 5 = 1026	

F

Main Grid

7. Mr Mackenzie has decided to move to South Africa with his family. He has been offered jobs in both Durban and Cape Town.

The typical monthly temperatures from March to August in Durban are recorded in the table below.

Month	**Temperature** (°C)
March	24
April	22
May	19
June	18
July	17
August	17

(a) For the typical monthly temperatures in Durban, calculate:

(i) the mean; **1**

(ii) the standard deviation. **3**

In Cape Town the mean monthly temperature for the same period is 15·5 °C and the standard deviation is 1·87 °C.

(b) Make two valid comments comparing the temperatures in both cities. **2**

F

Main Grid

7.	(a)	(i)	**Ans: 19·5(°)** •[1] Process: calculate mean	•[1] (24+22+19+18+17+17)÷6 = 19·5	1
		(ii)	**Ans: 2·88** •[2] Process: calculate $(x-\bar{x})^2$ •[3] Strategy: substitute into formula •[4] Process: calculate standard deviation	•[2] 20·25,6·25,0·25,2·25,6·25,6·25 •[3] $\sqrt{(41{\cdot}5\div 5)}$ •[4] 2·88	3
	(b)		**Ans: two valid comments** •[1] Communication: comment regarding mean •[2] Communication: comment regarding standard deviation	•[1] eg on average Durban's temperatures are higher •[2] eg Durban's temperatures are less consistent	2

F

Main Grid

Mr Mackenzie accepts the job in Durban.

As part of his job he is in contact with the London, New York and Mumbai offices of the company he works for.

He is planning a conference call at 3:30 pm the following day, from his office in Durban.

At 17:25 he noticed the clocks on the wall of his office showed the times below.

All offices work 08:00 to 18:00 local time.

(c) Which offices are available to take part in the conference call? **3**

F

Main Grid

7.	(c)		**Ans: New York and London** • [1] Strategy/process : calculate one local time • [2] Strategy/process: calculate the other two local times • [3] Communication: state offices which can take part	• [1] Mumbai 9:00pm London 1:30pm New York 8:30am • [2] calculate remaining two local times • [3] New York and London	**3**

F

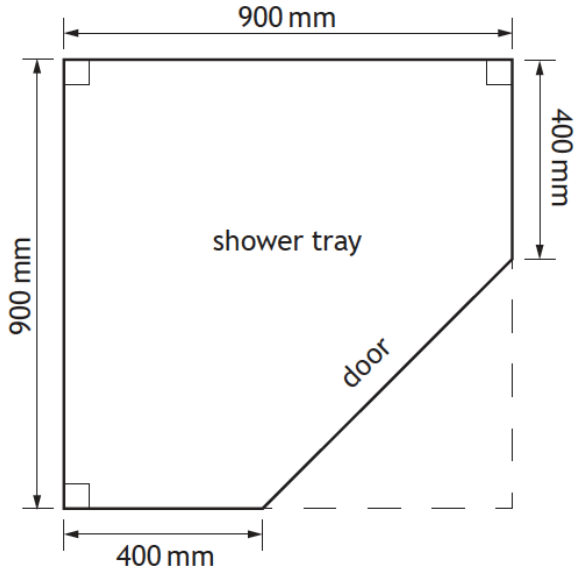
Main Grid

8. Zuzanna is remodelling her shower room.

She considers two designs.

The first design has a pentagonal shower tray.

The door will be fitted on the side of the tray as shown.



(a) Calculate the length of the side where the door will go. **3**

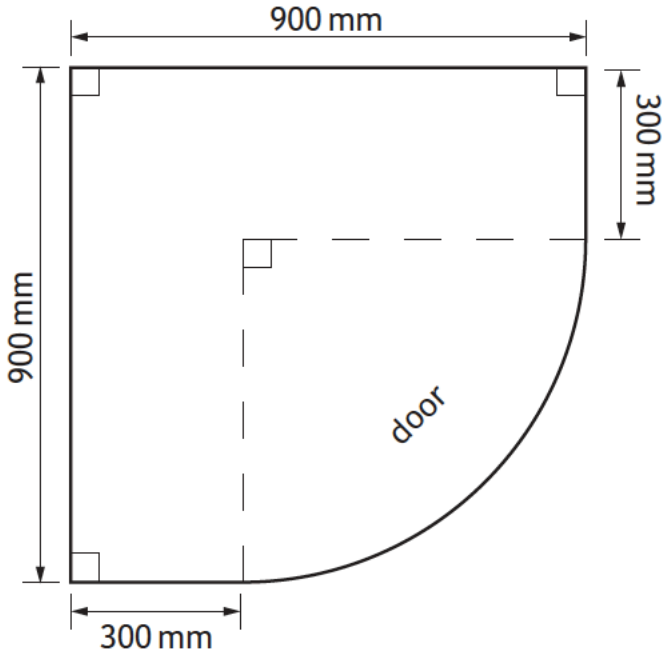
(b) Calculate the area of the pentagonal shower tray. **2**

The second design that Zuzanna is considering is the offset quadrant shower tray shown below.

F

Main Grid

The second design that Zuzanna is considering is the offset quadrant shower tray shown below.



The offset quadrant design has quarter of a circle forming part of the edge.

(c) Zuzanna will choose the design that gives the greater area.

Which design will Zuzanna choose, the pentagonal or the offset quadrant shower tray? **4**

Use your working to justify your answer.

F

Main Grid

8.	(a)		**Ans: 707 (mm)**		**3**
			• [1] Strategy: calculate short sides of triangle	• [1] 500	
			• [2] Strategy: evidence of the correct form of Pythagoras' theorem	• [2] $500^2 + 500^2$	
			• [3] Process: calculate length of hypotenuse of triangle	• [3] 707·1068...	
	(b)		**Ans: 685000(mm^2)**		**2**
			• [1] Strategy: evidence of calculating the area of the square encasing pentagonal shower base and subtract area of missing triangle	• [1] $900^2 - \frac{1}{2} \times 500 \times 500$	
			• [2] Process: calculate area of pentagonal base	• [2] 810000 − 125000 = 685000	

F

Main Grid

8.	(c)		**Ans: Zuzanna should pick the offset quadrant (since 732743 mm^2 > 685000 mm^2)**		**4**
			• [1] Strategy: evidence of quarter circle added to rectangles	• [1] Evidence	
			• [2] Process: calculate the area of the quarter circle	• [2] $\frac{1}{4} \times \pi \times 600 \times 600 = 282743$	
			• [3] Process: calculate area of shower tray	• [3] 282743 + 450000 = 732743	
			• [4] Communication: conclusion consistent with working	• [4] Zuzanna should pick the offset quadrant (since 732743 mm^2 > 685000 mm^2)	

F

Main Grid

1. Helen makes and sells candles.

These candles should be 22·5 cm tall.

She rejects any candle that is outwith the range of ±2 mm of this height.

Below are the heights, in centimetres, of 10 candles chosen at random.

22·2, 22·6, 22·5, 22·9, 22·3, 21·6, 22·6, 22·4, 22·7, 22·8

Calculate the percentage of candles that she rejects. **3**

F

Main Grid

1.			• [1] Process: calculate limits • [2] Process: identify rejected candles (or accepted candles) • [3] Process/communication: calculate percentage rejected [1,4]	• [1] 22·3 and 22·7 • [2] 22·2, 22·9, 21·6, 22·8 (or 22·6, 22·5, 22·3, 22·6, 22·4, 22·7) • [3] 40%	3

F

Main Grid

2. Paul usually works 30 hours each week.

He is paid time and a half for any **additional** hours that he works.

His basic rate of pay is £12·50.

Last week, he worked a total of 37 hours.

(a) Calculate his gross pay for last week. **3**

Paul is buying a new TV.

It is advertised at a price of £825.

He decides to use a payment plan to buy the TV.

The total cost of the TV using the payment plan is £845·80.

The payments are calculated as follows

- deposit of $\frac{1}{5}$ of **advertised** price
- 8 equal monthly instalments
- final payment of £100.

(b) Calculate the monthly instalment. **3**

F

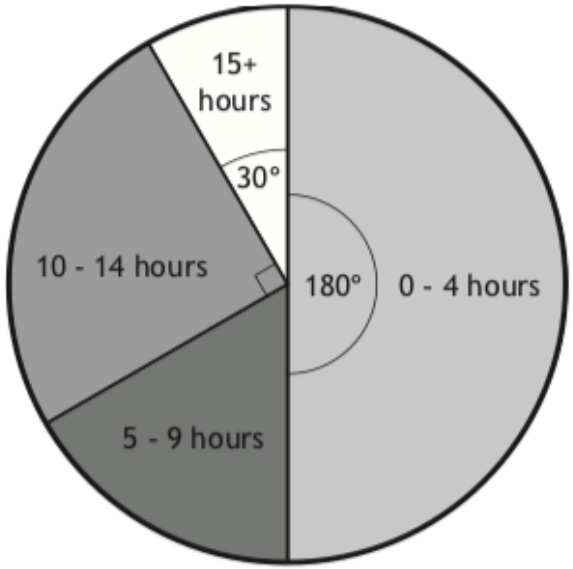
Main Grid

2.	(a)		$\bullet^1$ Process: calculate basic pay	$\bullet^1$ $30 \times 12{\cdot}50 = 375$	3
			$\bullet^2$ Strategy: know how to calculate overtime pay	$\bullet^2$ $1{\cdot}5 \times 12{\cdot}50 \times 7$	
			$\bullet^3$ Process: calculate total gross pay	$\bullet^3$ $375 + 131{\cdot}25 = 506{\cdot}25$	
	(b)		$\bullet^4$ Process: calculate the deposit	$\bullet^4$ $\frac{1}{5} \times 825 = 165$	3
			$\bullet^5$ Process: calculate amount still payable	$\bullet^5$ $845{\cdot}80 - (165 + 100) = 580{\cdot}80$	
			$\bullet^6$ Process: calculate how much each monthly payment is	$\bullet^6$ $580{\cdot}80 \div 8 = 72{\cdot}60$	

F

Main Grid

3. The pie chart shows the number of hours overtime that 72 employees of a supermarket worked during one month.



(a) Calculate how many employees worked 15+ hours overtime. **1**

(b) Calculate the probability that an employee chosen at random worked 9 or less hours overtime. **2**

F

Main Grid

3.	(a)		•[1] Process: calculate the number of employees	•[1] 6	1

Notes:

Commonly Observed Responses:

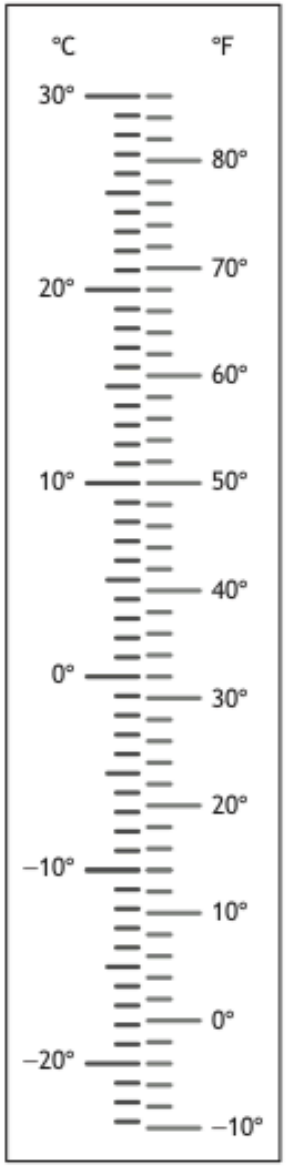
	(b)		•[2] Strategy/process: evidence of 240° or 48 employees •[3] Communication: state probability	•[2] evidence •[3] $\frac{240}{360}$ or $\frac{48}{72}$ or $\frac{2}{3}$ or equivalent	2

F

Main Grid

4. Gillian thinks that 24 °F is colder than −3 °C.

A thermometer is shown.



Determine if she is correct.

Justify your answer.

2

F

Main Grid

4.			•[1] Strategy/communication: one temperature marked correctly on scale •[2] Communication: other temperature marked on scale and consistent conclusion	•[1] evidence •[2] eg Gillian is correct with justification	2
			Alternative Strategy •[1] Strategy/communication: substitute into formula •[2] Communication: temperature conversion and consistent conclusion	•[1] $F=\frac{9}{5}\times(-3)+32$ or equivalent •[2] 26·6 °F or -4·4 °C with consistent conclusion	

F

Main Grid

5. Allana takes out a loan of £4500.

The interest plus the administration fee is 7·5% of the loan amount.

The total amount will be paid back in 9 equal monthly payments.

Calculate the monthly payment. **3**

F

Main Grid

5.			•[1] Strategy: know how to find monthly payment •[2] Process: calculate interest and fee •[3] Process: calculate monthly payment	•[1] evidence of finding a percentage, adding to 4500 and dividing by 9 •[2] 7·5% of 4500 = 337·50 •[3] (4500 + 337·50) ÷ 9 = 537·50	3
			Alternative Strategy •[1] Strategy: know how to find monthly payment •[2] Process: calculate amount owed •[3] Process: calculate monthly payment	•[1] evidence of multiplying by 1·075 and dividing by 9 •[2] 4837·50 •[3] 4837·50 ÷ 9 = 537·50	

F

Main Grid

6. Write the following values in order from greatest to least.

$$0{\cdot}388,\ \frac{3}{8},\ 38{\cdot}38\%,\ 0{\cdot}39$$

Justify your answer. 2

F

Main Grid

6.			• [1] Strategy/process: put decimals and percentage in correct order • [2] Process/communication: convert $\frac{3}{8}$ correctly and put it in correct position	• [1] 0·39, 0·388, 38·38% • [2] $\frac{3}{8} = 0{\cdot}375$ or 37·5% $0{\cdot}39, 0{\cdot}388, 38{\cdot}38\%, \frac{3}{8}$	2

F

Main Grid

7. An airline records the number of passengers who fail to turn up for their flights each month.

The numbers for 2017 are

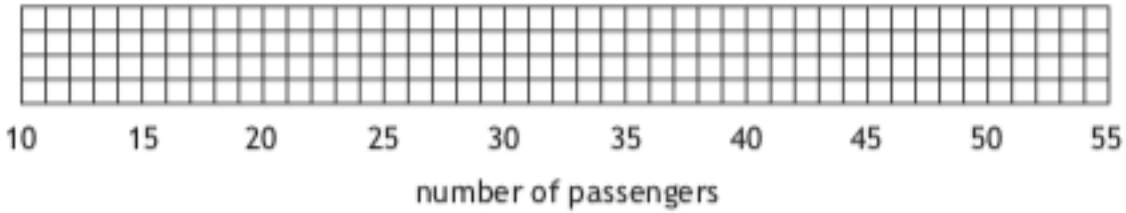
25, 14, 32, 29, 20, 43, 17, 20, 38, 27, 49, 23.

(a) For this data, calculate

- the median
- the lower quartile
- the upper quartile. **2**

(b) Construct a boxplot for this set of data.

(An additional grid, if required, can be found on *page 17*) **2**



(c) Calculate the interquartile range for this set of data. **1**

In 2016, the interquartile range for the number of passengers who failed to turn up for their flights was 17.

(d) Make one valid comment comparing the number of passengers who failed to turn up for their flights in these two years. **1**

F

Main Grid

7.	(a)	$\bullet^1$ Strategy/process: put numbers into order and state the median	$\bullet^1$ Median = 26	2
		$\bullet^2$ Process: find the lower quartile and upper quartile	$\bullet^2$ $Q_1 = 20$, $Q_3 = 35$	
	(b)	$\bullet^3$ Strategy: correct end points	$\bullet^3$ End points at 14 and 49	2
		$\bullet^4$ Strategy: correct box	$\bullet^4$ Box showing Q_1, Q_2 and Q_3	
	(c)	$\bullet^5$ Process: calculate interquartile range	$\bullet^5$ $35 - 20 = 15$	1
	(d)	$\bullet^6$ Communication: valid comment	$\bullet^6$ eg In 2016, the number of passengers who failed to turn up was more varied.	1

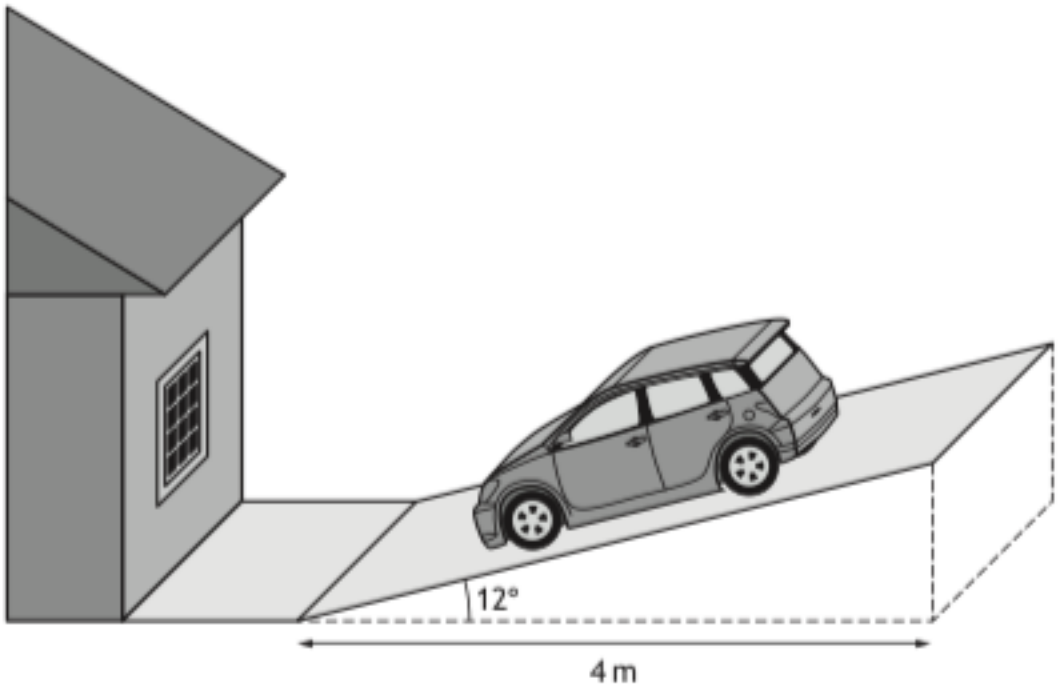
F

Main Grid

8. Sarah's driveway is sloped as shown in the diagram below.

The cross-section of the driveway is in the shape of a right-angled triangle.

The base is 4 metres long and makes an angle of 12° with the driveway as shown in the diagram below.



(a) Construct a scale drawing of the cross-section of the driveway.

Use a scale of 1 cm : 0·5 m. **2**

(b) Use your scale drawing to calculate the gradient of the driveway. **2**

F

Main Grid

8.	(a)		•[1] Process/communication: correct length drawn •[2] Process/communication: correct angles measured	•[1] 8(±0·1cm) •[2] $12°(\pm1°)$; $90°(\pm1°)$	2
	(b)		•[3] Strategy/communication: measure vertical height •[4] Process/communication: calculate gradient and simplify where appropriate	•[3] height consistent with scale drawing •[4] eg 0·2125 or $\frac{17}{80}$	2

F

Main Grid

9. After a meeting in Beijing, Jennifer flies home to London via Amsterdam.

The plane leaves Beijing on 3 February at 12:15 local time.

The plane lands in Amsterdam on 3 February at 18:00 local time.

Beijing is 7 hours ahead of Amsterdam.

(a) Calculate the time taken for Jennifer's flight from Beijing to Amsterdam.

Give your answer in hours and minutes. **1**

On landing in Amsterdam, Jennifer's phone tells her the time and date in the following cities.

Amsterdam, Netherlands	18:00	3 Feb
London, United Kingdom	17:00	3 Feb
Miami, United States of America	12:00	3 Feb

- Jennifer plans to telephone her brother as soon as she gets home.
- She will arrive at her home, in London, at 23:15 local time.
- Her brother lives in Miami, and arrives home from work at 17:00 local time.

(b) Determine whether her brother will be home from work when Jennifer makes the phone call.

Use your working to justify your answer. **2**

F

Main Grid

9.	(a)		• [1] Process: calculate time taken	• [1] 12 hours and 45 minutes	1
	(b)		• [2] Process: calculate time difference • [3] Process/communication: conclusion consistent with working	• [2] 5 hours • [3] 23:15 – 5 hours = 18:15 Yes the call will be made at 18:15 in Miami	2

F

Main Grid

10. A basic cookie dough mix requires butter, sugar, flour and chocolate chips.

- $\frac{1}{6}$ of the mix is butter
- $\frac{1}{3}$ of the mix is sugar
- $\frac{1}{4}$ of the mix is chocolate chips
- The rest of the mix is flour

Calculate the fraction of the mix that is flour. **3**

F

Main Grid

10.			• 1 Process: evidence of common denominator • 2 Process: consistent numerators and add fractions • 3 Process: calculate fraction of flour needed	• 1 $\frac{\quad}{12}+\frac{\quad}{12}+\frac{\quad}{12}$ or equivalent • 2 $\frac{2}{12}+\frac{4}{12}+\frac{3}{12}=\frac{9}{12}$ • 3 $\frac{3}{12}$	3
			Alternative Strategy 1 • 1 Process: add together two fractions • 2 Process: add remaining fraction • 3 Process: calculate fraction of flour needed	• 1 eg $\frac{1}{4}+\frac{1}{3}=\frac{7}{12}$ or equivalent • 2 eg $\frac{7}{12}+\frac{1}{6}=\frac{9}{12}$ • 3 $\frac{3}{12}$	

F

Main Grid

11. Mary gave some money to four of her nieces.

It was shared **in proportion to** their ages.

Name	Age
Jane	4
Heather	11
Laura	9
Kate	6

Kate's share is £1950.

Calculate the total amount Mary gifted her nieces. **3**

F

Main Grid

11.			• 1 Strategy/process: find one share	• 1 $1950 \div 6 = 325$	3
			• 2 Process: add up ages	• 2 $4 + 11 + 9 + 6 = 30$	
			• 3 Process: find total amount	• 3 $325 \times 30 = 9750$	
			Alternative Strategy 1		
			• 1 Strategy/process: find one share	• 1 $1950 \div 6 = 325$	
			• 2 Process: calculate the amount for any niece other than Kate	• 2 Jane 1300 or Heather 3575 or Laura 2925	
			• 3 Process: calculate the amount for other two nieces and total amount	• 3 1300 + 3575 + 2925 + 1950 = 9750	

F

Main Grid

12. Kieran and Gemma have each set themselves a monthly electricity allowance.

Kieran has set himself an allowance of £42.

Gemma has set herself an allowance of £49.

At the end of July, their smart meters recorded that

- Kieran had used £15 of his allowance
- Gemma had used £21 of her allowance.

Determine who had used a greater proportion of their allowance.

Use your working to justify your answer. **3**

F

Main Grid

12.		• [1] Strategy/communication: know to create fractions and state fractions • [2] Strategy/process: knows how to compare fractions • [3] Strategy/communication: state conclusion consistent with working	• [1] $\frac{15}{42}$ and $\frac{21}{49}$ • [2] eg $\frac{5}{14}$ and $\frac{6}{14}$ • [3] Gemma (since $\frac{6}{14} > \frac{5}{14}$)	3

F

Main Grid

13. Joe had a business meeting in London.

He travelled from home to his meeting by car.

- He arrived at his meeting at 11:45
- He travelled 220 miles to his meeting at an average speed of 50 mph
- During his journey he stopped for half an hour for breakfast

Calculate the time he left home. 4

F

Main Grid

13.			• [1] Process: calculates time taken to travel 220 miles at 50 mph • [2] Process: changes decimal hours into minutes • [3] Strategy/process: evidence of adding on 30 minutes correctly • [4] Process: calculate latest time of departure.	• [1] 220 ÷ 50 = 4·4 hrs • [2] 0·4 hrs = 24 min • [3] 4 hrs 24 min + 30 min = 4 hrs 54 min • [4] 06:51	4

F

Main Grid

1. Sam buys a rare stamp for his stamp collection at an auction. He buys the stamp for £920.

The stamp

- increased in value by 7% in each of the first 2 years
- decreased in value by 4% in the third year.

Calculate the value of the stamp after these 3 years.

Give your answer **to 3 significant figures.** 4

F

Main Grid

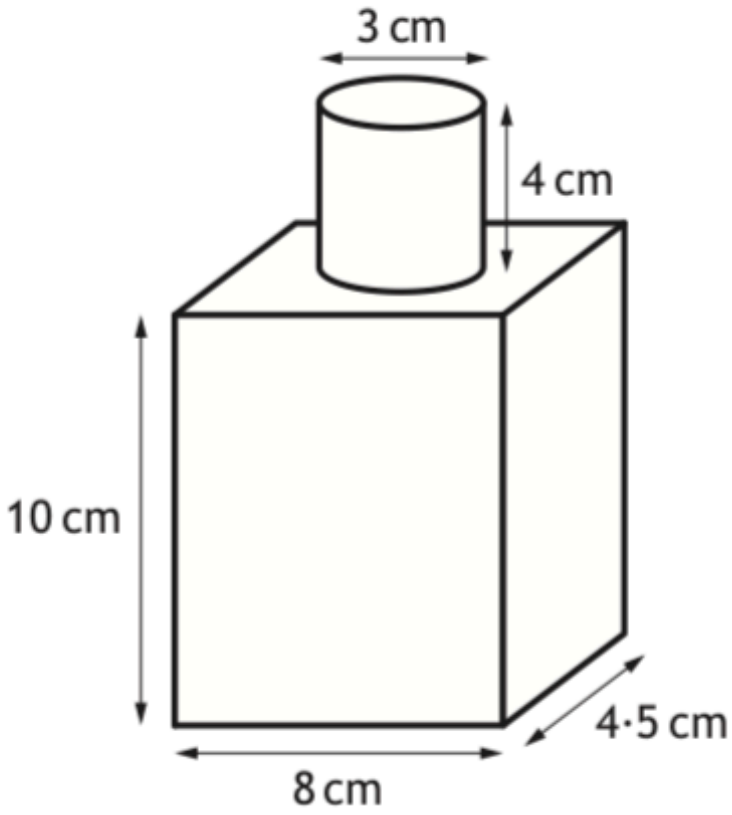
1.		• [1] Strategy: know how to calculate percentage increase • [2] Strategy: identify power • [3] Strategy: know how to calculate percentage decrease • [4] Process: calculate the value of the stamp after 3 years and round to 3 significant figures	• [1] Evidence of 1·07 or equivalent • [2] ...[2] or equivalent • [3] Evidence of 0·96 or equivalent • [4] 1011·18 = 1010	4

F

Main Grid

2. A bottle consists of a cuboid and a cylinder.

The dimensions are shown in the diagram.



Calculate the volume of the bottle. **4**

F

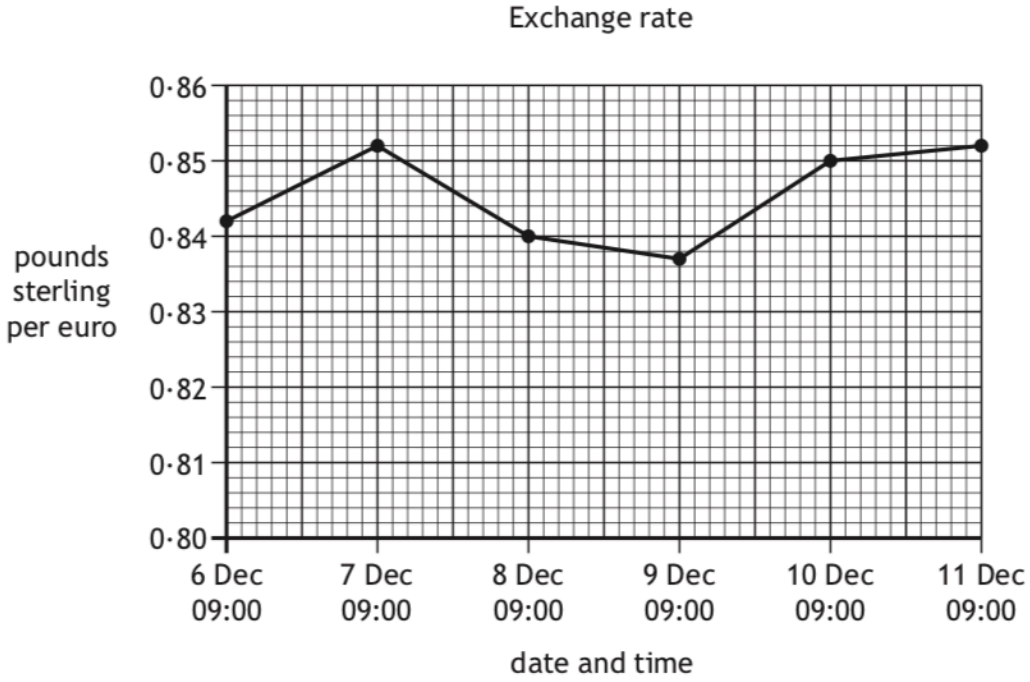
Main Grid

2.			• 1 Strategy: substitute correctly into cylinder formula	• 1 $\pi \times 1 \cdot 5^2 \times 4$	4
			• 2 Process: calculate the volume of the cylinder	• 2 $28 \cdot 27 \ldots$	
			• 3 Process: calculate the volume of the cuboid	• 3 $4 \cdot 5 \times 10 \times 8 = 360$	
			• 4 Process/communication: find the total volume of the bottle	• 4 $360 + 28 \cdot 27 = 388 \cdot 27 \text{cm}^3$	

F

Main Grid

3. The graph shows how many pounds sterling could be bought for 1 euro during December 2017.



Daniel changed 250 euros to pounds sterling at 09:00 on 7 December.

(a) Calculate how many pounds he received. **2**

Daniel was working in France.

He bought a laptop costing 400 euros.

He calculated this was equivalent to £334·80.

(b) Use the graph to find the date that Daniel bought the laptop.

Use your working to justify your answer. **2**

F

Main Grid

3.	(a)	•[1] Communication: read rate of exchange from graph •[2] Process: calculate amount in pounds	•[1] 0·852 •[2] $0{\cdot}852 \times 250 = 213$	2
	(b)	•[3] Strategy/process: calculate exchange rate •[4] Communication: state date consistent with working	•[3] $334{\cdot}80 \div 400 = 0{\cdot}837$ or $400 \times 0{\cdot}837 = 334{\cdot}80$ •[4] 9 December	2

F

Main Grid

4. Karen buys and sells silver, gold and platinum.

The table shows the price per ounce of each of these metals, on the first trading day of each month, over the last year.

Month	Price of silver	Price of gold	Price of platinum
Jan	15·60	1170	1275
Feb	17·40	1140	1050
Mar	16·50	1210	1100
Apr	17·00	1200	1150
May	16·70	1190	1100
Jun	16·70	1275	1075
Jul	15·60	1175	1100
Aug	14·50	1190	850
Sep	14·60	1140	975
Oct	14·50	1125	1000
Nov	15·60	1195	1125
Dec	16·50	1200	1200
All prices in US dollars			

Karen bought 1 ounce of gold on the first trading day in March and sold it on the first trading day in September.

Calculate the percentage loss she made.

Give your answer **to 2 decimal places**. **3**

F

Main Grid

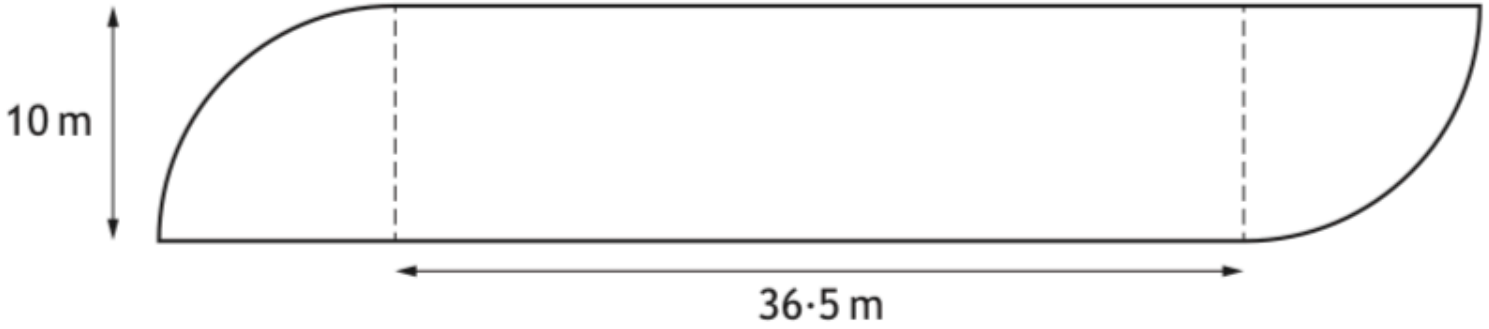
4.			• [1] Strategy: identify the price of gold • [2] Strategy: know how to calculate the percentage loss • [3] Process/Communication: calculate percentage loss and round to 2 decimal places	• [1] 1210 and 1140 • [2] $(1210-1140)\div 1210\times 100$ • [3] 5·79	**3**

F

Main Grid

5. A hotel is having a swimming pool built.

It is in the shape of a rectangle and two quarter circles as shown below.



The swimming pool will have a safety rail fitted around its edge.

- There will be two 125 cm wide gaps to allow access to the pool
- Safety rail is sold in 3 metre lengths
- Each 3 metre length costs £11·49

Calculate the minimum cost of the safety rail for the pool. **5**

F

Main Grid

5.			• 1 Strategy: know how to find arc length of quarter or semi-circle	• 1 $\frac{20\pi}{4}$ or $\frac{20\pi}{2}$	5
			• 2 Process: calculate curved edge of one quarter circle or semi-circle	• 2 $15\cdot7\ldots$ or $31\cdot4\ldots$	
			• 3 Process: calculate perimeter of swimming pool	• 3 $2\times15\cdot7\ldots+2\times10+2\times36\cdot5=124\cdot4\ldots$	
			• 4 Strategy: know how to calculate number of lengths	• 4 $(\ldots-2\times1\cdot25)\div3$	
			• 5 Process: calculate number of lengths, appropriate rounding and calculate cost	• 5 $40\cdot6$ leading to $41\times11\cdot49=471\cdot09$	

F

Main Grid

6. Denisa bought 375 shares for £4·50 per share.

She later sold them all for £5·20 per share.

She had to pay commission of 2·7% of the total selling price.

Calculate her total profit. **3**

F

Main Grid

6.			• [1] Process: calculate total selling price • [2] Process: calculate 2·7% of total selling price • [3] Process: calculate profit	• [1] 375 × 5·20 = 1950 • [2] 1950 × 0·027 = 52·65 • [3] 1950 − (1687·50 + 52·65) = 209·85	3

F

Main Grid

7. The birth weight of babies in a hospital in 2017 was recorded.

A sample of the weights, in kilograms, is shown.

2·5 4·5 3·7 3·1 3·8 3·4

(a) For these weights, calculate

(i) the mean **1**

(ii) the standard deviation. **3**

The birth weight of babies born in hospital in 1987 was also recorded. The mean weight in 1987 was 3·4 kg and the standard deviation was 0·95 kg.

(b) Make two valid comparisons about the weight of babies in 1987 and 2017. **2**

F

Main Grid

7.	(a)	(i)	•[1] Process: calculate mean	•[1] $(2{\cdot}5 + 4{\cdot}5 + 3{\cdot}7 + 3{\cdot}1 + 3{\cdot}8 + 3{\cdot}4) \div 6 = 3{\cdot}5$	1
		(ii)	•[2] Process: calculate $(x - \bar{x})^2$	•[2] 1,1,0·04,0·16,0·09,0·01	3
			•[3] Strategy/process: substitute into formula	•[3] $\sqrt{\frac{2 \cdot 3}{6-1}}$	
			•[4] Process: calculate standard deviation	•[4] 0·678...	
	(b)		•[5] Communication: comment regarding mean	•[5] eg on average weights in 2017 are higher	2
			•[6] Communication: comment regarding standard deviation	•[6] eg the weights in 2017 are more consistent	

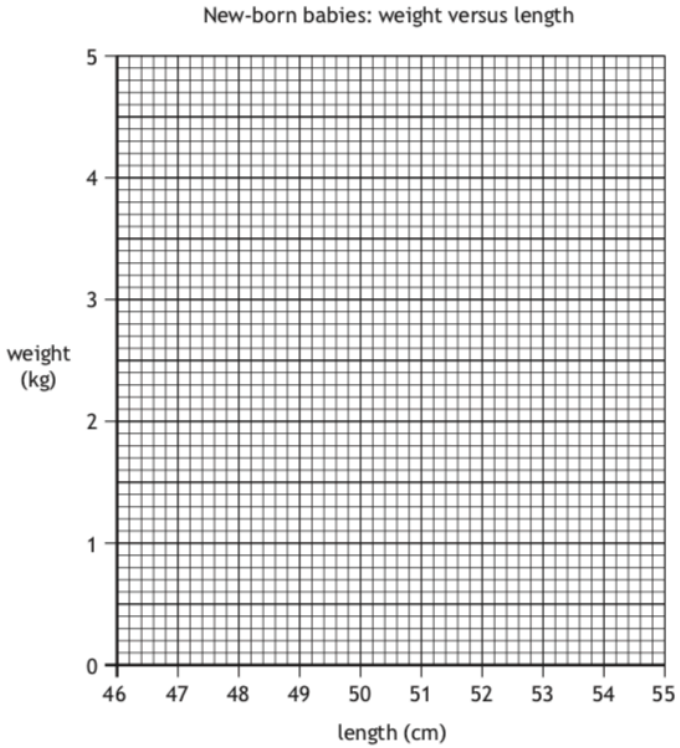
F

Main Grid

Length (cm)	46	47	49	51	52	52	54	55
Weight (kg)	2·7	2·8	3·5	3·7	3·4	3·7	4·0	4·4

(c) (i) On the grid draw a scatter graph to show this data. **2**

(An additional grid, if required, can be found on *page 20*.)



(ii) Draw a line of best fit on your scatter graph. **1**

(iii) Use your line of best fit to estimate the weight of a baby who was 50 cm when born. **1**

F

Main Grid

7.	(c)	(i)	•[7] Communication: 4 points correct •[8] Communication: all 8 points correct	•[7] evidence •[8] evidence	2
		(ii)	•[9] Strategy: consistent line of best fit	•[9] evidence	1
	(iii)		•[10] Communication: answer consistent with line of best fit	•[10] evidence	1

F

Main Grid

7. (continued) MARK

Baby milk powder is sold in 900 g packs.

The feeding guide from one of these packs is shown.

Approximate baby weight (kg)	Number of feeds per 24 hours	Number of level scoops per feed	Quantity of water per feed	
			ml	fl oz
less than 3·5	6	3	60	2
3·5 up to 4·0	6	4	90	3
4·0 up to 5·0	5	6	120	4
5·0 up to 6·5	5	7	150	5
6·5 up to 7·5	4	8	180	6
7·5 or more	3	7	150	5

Each level scoop contains 4·5 g of milk powder.

Baby Andrew weighs 7·1 kg.

(d) Determine whether a 900 g pack of milk powder will last Andrew 1 week.

Use your working to justify your answer. 3

F

Main Grid

(d)		• [11] Strategy: identify correct row in table	• [11] eg 8 (scoops)	3
		• [12] Process: calculate milk powder needed for 1 week or equivalent	• [12] $4 \times 8 \times 7 \times 4 \cdot 5 = 1008$ OR $4 \cdot 5 \times 4 \times 8 = 144$ $900 \div 144 = 6 \cdot 25$	
		• [13] Communication: conclusion consistent with working	• [13] No, (as 1008g > 900g) OR No, (as 6·25 < 7 days)	

F

Main Grid

8. A new road bridge has been built.

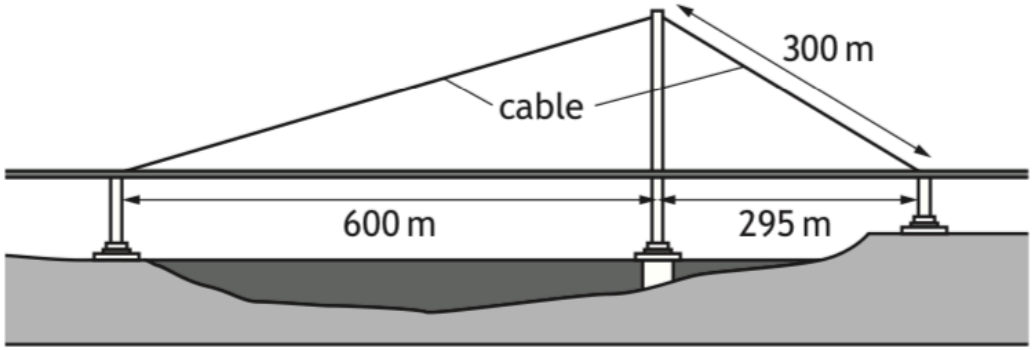
A worker paints 367 lines along the centre of the road.

- Each line is four metres long
- There is a gap of two metres between each line
- The first line starts at the beginning of the bridge
- The last line finishes at the end of the bridge

(a) Calculate the length of the bridge. **2**

Two cables support a section of the bridge.

This section forms two right-angled triangles, as shown in the diagram.



(b) Calculate the total length of cable needed for this section of bridge.

Do not use a scale drawing. **4**

F

Main Grid

8.	(a)		$\bullet^1$ Strategy/process: identify number of gaps	$\bullet^1$ 366	2
			$\bullet^2$ Process: calculate length	$\bullet^2$ $366 \times 2 + 367 \times 4 = 2200$	
	(b)		$\bullet^3$ Strategy/communication: correct substitution in Pythagoras' Theorem	$\bullet^3$ eg $300^2 - 295^2$	4
			$\bullet^4$ Process: calculate height or height^2	$\bullet^4$ $h = 54{\cdot}5\ldots$ or $h^2 = 2975$	
			$\bullet^5$ Strategy/communication: correct substitution in Pythagoras' Theorem	$\bullet^5$ $600^2 + (54 \cdot 5\ldots)^2$	
			$\bullet^6$ Process/communication: calculate total length of cable	$\bullet^6$ $300 + 602 \cdot 4\ldots = 902 \cdot 4\ldots$	

F

Main Grid

9. David is writing his new book.

He spends

- 210 hours on research
- 96 hours in meetings
- 234 hours writing the book.

(a) Construct a pie chart to illustrate this information. **3**

(An additional diagram, if required, can be found on *page 21*.)

F

Main Grid

9.	(a)		$\bullet^1$ Process: calculate total number of hours $\bullet^2$ Process: calculate angles $\bullet^3$ Communication: draw and label pie chart consistent with previous working	$\bullet^1$ $210 + 96 + 234 = 540$ $\bullet^2$ 210 hours research: $\frac{210}{540} \times 360 = 140$ 96 hours meetings: $\frac{96}{540} \times 360 = 64$ 234 hours writing: $\frac{234}{540} \times 360 = 156$ $\bullet^3$ diagram consistent with working	**3**

F

Main Grid

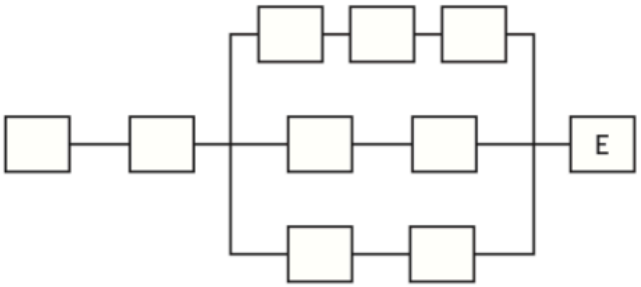
9. (continued)

The publishing company produced the following table to show all the tasks involved in publishing the book.

Activity	Description	Preceding task
A	Illustrate cover	H
B	Write 1st draft	C
C	Research ideas	None
D	Edit book	B
E	Publish book	A,J,G
F	Re-work	D
G	Proof read	F
H	Choose title	B
I	Copyright	B
J	ISBN	I

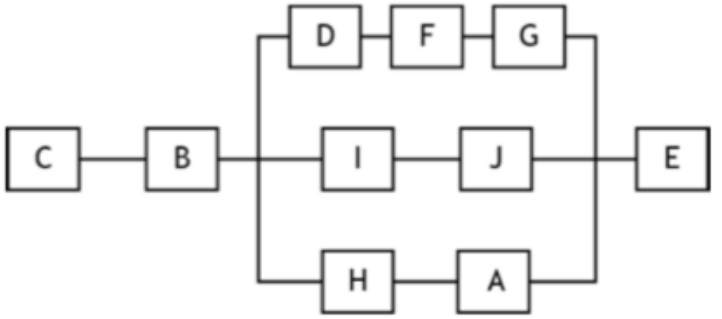
(b) Complete the diagram below to show the tasks. **2**

(An additional diagram, if required, can be found on *page 21*.)



F

Main Grid

(b)		• [4] Communication: any 5 in correct sequence • [5] Communication: remaining 4 in correct sequence		2

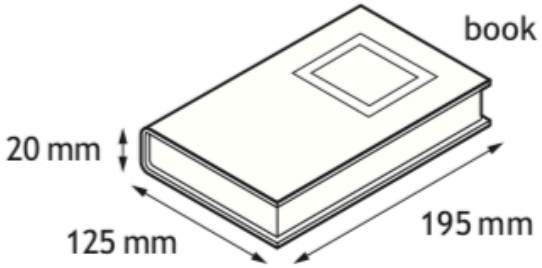
F

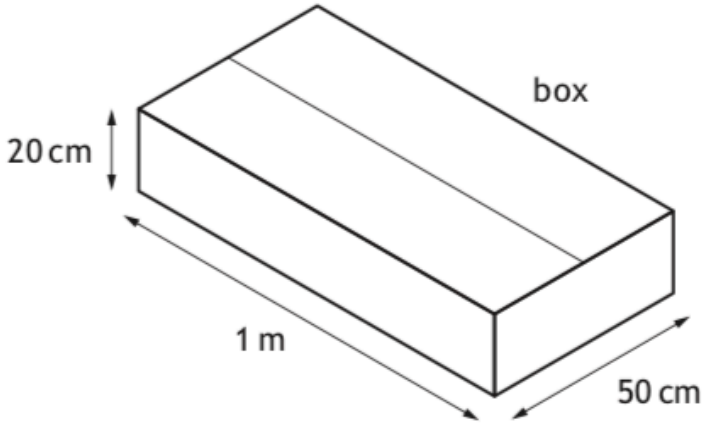
Main Grid

9. (continued)

The books are to be packed in boxes for transporting to the bookshops.

The dimensions of the book and the internal dimensions of the box are shown in the diagrams.





The books need to be laid with the front cover facing upwards in the boxes.

They must all be aligned in the same direction.

(c) Calculate the maximum number of books that can be packed into each box.

3

F

Main Grid

9.	(c)		•[6] Strategy: know to and starts to calculate the correct two ways of packing •[7] Process: calculate number of boxes for one arrangement •[8] Process/communication: calculate the second arrangement and state maximum number of books	•[6] evidence of the two **correct** ways of packing with the front cover facing upwards •[7,8] $100 \div 12 \cdot 5 = 8$ $50 \div 19 \cdot 5 = 2 \cdot 56\ldots$ $20 \div 2 = 10$ $2 \times 8 \times 10 = 160$ and $100 \div 19 \cdot 5 = 5 \cdot 12\ldots$ $50 \div 12 \cdot 5 = 4$ $20 \div 2 = 10$ $5 \times 4 \times 10 = 200$ Maximum - 200 books	3

F

Main Grid

9. (continued)

This is the fourth book that David has written in this series of books.

The cost of each book is shown in the table.

Book	Cost	Year published
1	£5·50	2013
2	£8·50	2015
3	£4·00	2016
4	£12·00	2019

The following special offers are available to buy all four books.

(d) Determine which shop offers the best deal for buying all four books.

Use your working to justify your answer. 3

F

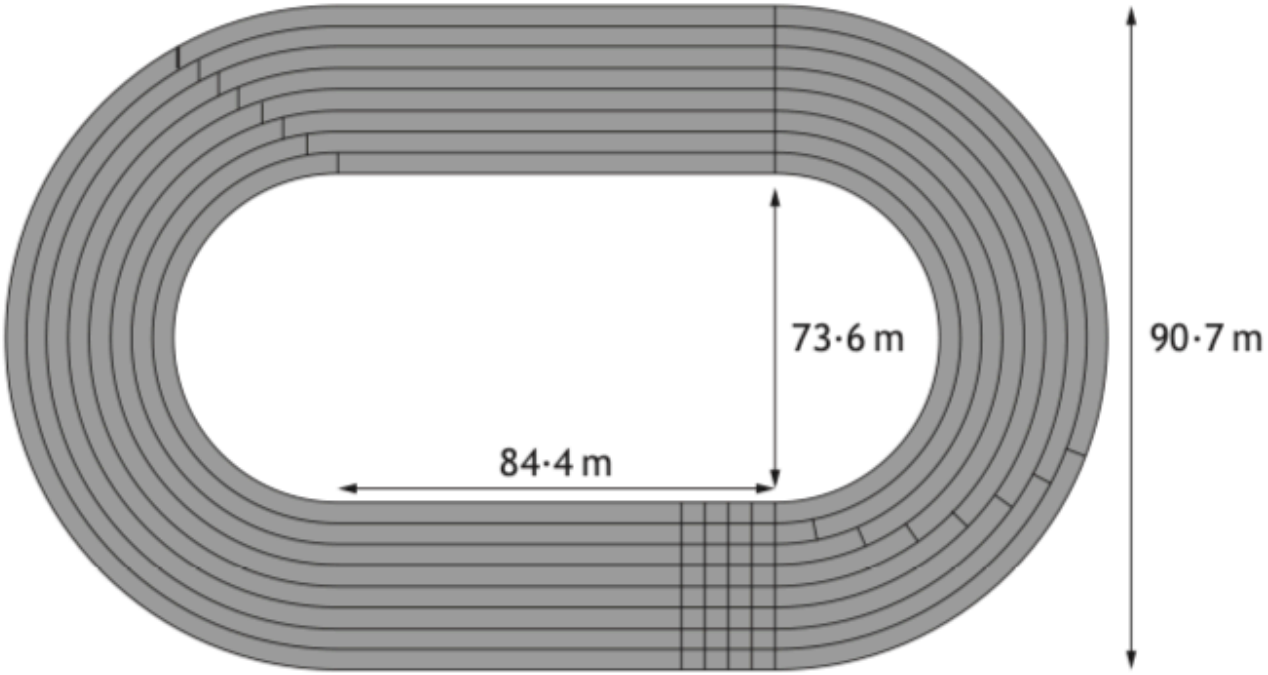
Main Grid

(d)		• M9 Process: calculate cost of shop A • M10 Process: calculate cost of shop C • M11 Communication: conclusion consistent with working	• M9 24 • M10 22 • M11 Shop C	3

F

Main Grid

10. A sports ground is in the shape of a rectangle and two semi-circles as shown.



The running track is shaded in the diagram.

(a) Calculate the area of the running track. **5**

F

Main Grid

10.	(a)		$\bullet^1$ Process: calculate area of larger circle	$\bullet^1$ $\pi \times 45 \cdot 35^2 = 6461 \cdot 07\ldots$	5
			$\bullet^2$ Process: calculate area of smaller circle	$\bullet^2$ $\pi \times 36 \cdot 8^2 = 4254 \cdot 47\ldots$	
			$\bullet^3$ Process: subtract areas of circles	$\bullet^3$ $2206 \cdot 599\ldots$	
			$\bullet^4$ Process: calculate the area of the two rectangles	$\bullet^4$ $8 \cdot 55 \times 84 \cdot 4 \times 2 = 1443 \cdot 24$	
			$\bullet^5$ Process: calculate overall area	$\bullet^5$ $2206 \cdot 599\ldots + 1443 \cdot 24 = 3649 \cdot 839\ldots$	

F

Main Grid

10. (continued)

The running track is to be resurfaced.

A resurfacing company has a team of 5 workers who can resurface a track of this size in 42 hours.

The resurfacing company are now able to provide 2 more workers to resurface this track.

All the workers work at the same rate.

(b) Calculate the time it will now take to resurface the track. **3**

F

Main Grid

(b)		• [6] Strategy: know to use inverse proportion • [7] Process: calculate time for 1 worker • [8] Process: calculate time for 7 workers	• [6] evidence • [7] $42 \times 5 = 210$ • [8] $210 \div 7 = 30$	3

F

Main Grid

10. (continued)

John works for the resurfacing company.

His annual salary is £17 108.

National Insurance is calculated on a person's salary **before** deductions such as pension contributions.

National Insurance rates	
Up to £8424	0%
From £8424 to £46 384	12%
Over £46 384	2%

(c) (i) Calculate John's annual National Insurance payment. **2**

John pays 7% of his annual salary into his pension.

John's annual income tax is £1051·60.

(ii) Calculate John's annual net pay. **2**

F

Main Grid

(c)	(i)	•[9] Strategy/process: know to deal with 0% rate •[10] Process: calculate national insurance	•[9] 17108 – 8424 = 8684 •[10] 12% of 8684 = 1042·08	2
(ii)		•[11] Process: calculate pension contribution •[12] Process: calculate annual net pay	•[11] 1197·56 •[12] $17108 - 1042 \cdot 08 - 1197 \cdot 56 - 1051 \cdot 60 = 13816 \cdot 76$	2

F

Main Grid