Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics

Paper 2 (Calculator)

Solutions

Higher Tier

Mock Set 3 – Autumn 2017
Time: 1 hour 30 minutes

Paper Reference
1MA1/2H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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6/7/4/4/

S 5 7 4 9 4 A 0 1 2 4

Pearson

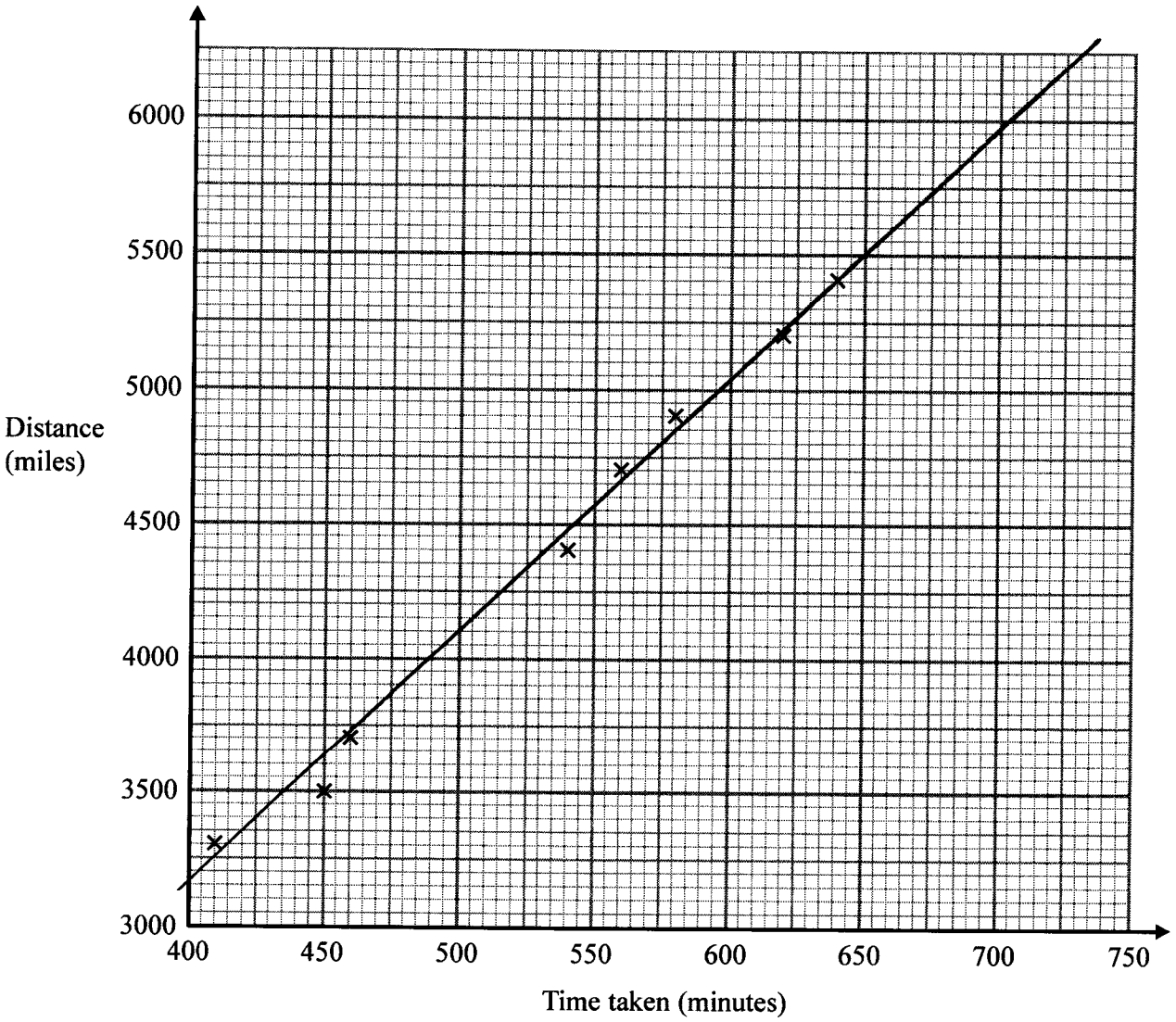
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Oliver records the distance from London to each of eight cities in the USA.
He also records the time taken to fly from London to each of these cities.

The scatter graph shows this information.



Chicago is a city in the USA.
Chicago is 4000 miles from London.

(a) (i) By drawing a line of best fit, find an estimate for the time taken to fly from London to Chicago.

490 minutes

(2)

(ii) Why is your answer to part (i) only an estimate?

Different flying conditions could cause flight times to vary

(1)

(b) (i) Calculate the gradient of your line of best fit.

$\frac{5500 - 3500}{650 - 430} = \frac{2000}{220} = 9.1$

9.1

(2)

(ii) Give an interpretation of the gradient of your line of best fit.

Speed in miles per minute

(1)

(Total for Question 1 is 6 marks)

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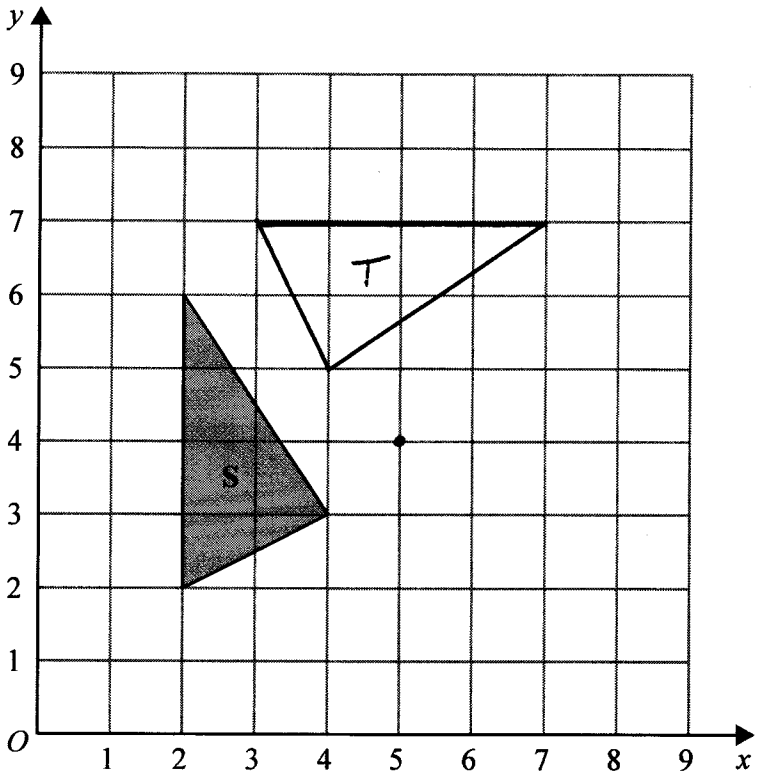


(a) Rotate shape **S** 90° clockwise, centre (5, 4)
Label your image **T**.

(2)

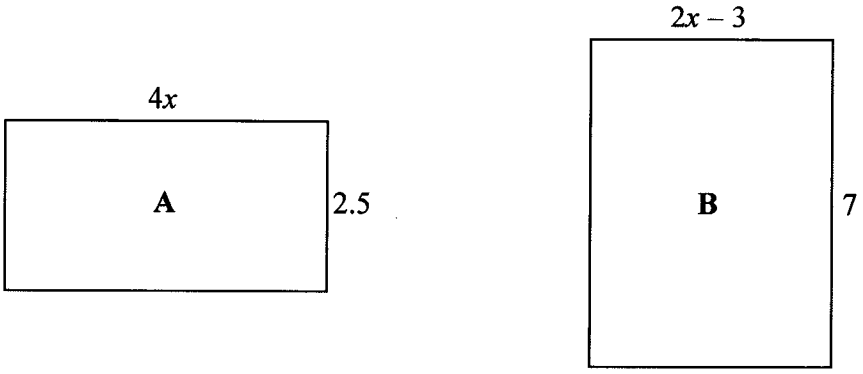
(b) Describe fully the single transformation that will map shape **T** onto shape **S**.

Rotation by 90° anti-clockwise about (5, 4)

(1)

(Total for Question 2 is 3 marks)

3 Here are two rectangles.



All measurements are in centimetres.

The area of rectangle **A** is equal to the area of rectangle **B**.

Work out the perimeter of rectangle **B**.

$4x \times 2.5 = 7(2x-3)$

$10x = 14x - 21$

$21 = 14x - 10x$

$21 = 4x$

$\frac{21}{4} = x$

Perimeter of B $= 2x - 3 + 7 + 2x - 3 + 7$

$= 4x + 8$

$= 4\left(\frac{21}{4}\right) + 8$

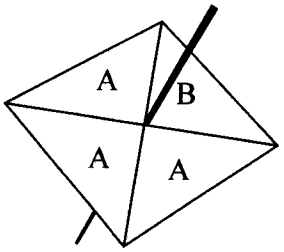
$= 21 + 8$

$= 29\text{cm}$

29 cm

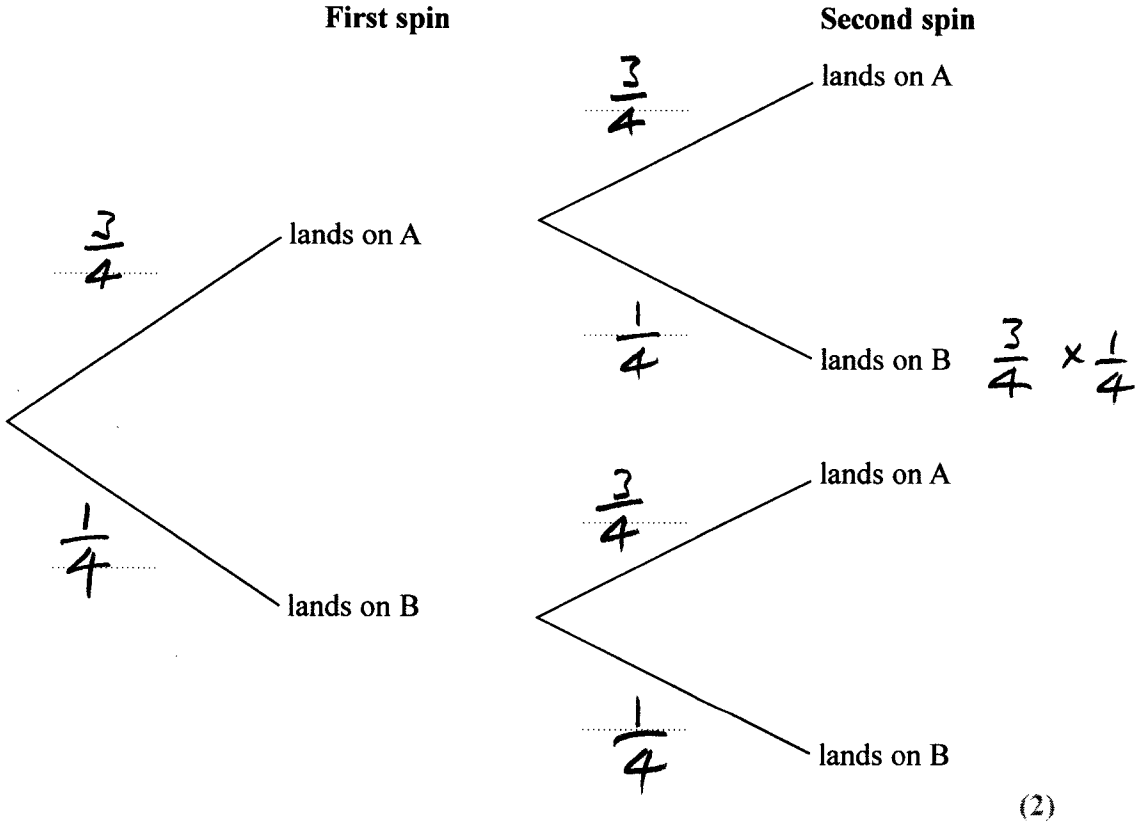
(Total for Question 3 is 5 marks)

4 The diagram shows a fair 4-sided spinner.



Hasmeet is going to spin the spinner twice.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that the spinner will land on A on the first spin and will land on B on the second spin.

$= \frac{3}{4} \times \frac{1}{4} = \frac{3}{16}$

(2)

(Total for Question 4 is 4 marks)

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5 $S = \pi^2(b^2 - a^2)$

$a = 8$, $b = 10$

Calculate the value of S.
Give your answer correct to 3 significant figures.

$S = \pi^2(10^2 - 8^2) = 355.3$

$= 355$ to 3 s.f.

355

(Total for Question 5 is 2 marks)

6 Only blue vans and white vans are made in a factory.

The ratio of the number of blue vans to the number of white vans is 4 : 3

(a) Write down the fraction of vans that are blue.

$\frac{4}{7}$

(1)

For blue vans,

the number of small vans : the number of large vans = 3 : 5

(b) Work out the fraction of the number of vans made in the factory that are blue and large.

Large fraction of blue $= \frac{5}{8}$

$\frac{\cancel{4}^{1}}{7} \times \frac{5}{\cancel{8}_{2}} = \frac{5}{14}$

$\frac{5}{14}$

(3)

(Total for Question 6 is 4 marks)

7 (a) Find the reciprocal of 5

$\frac{1}{5}$

(1)

(b) Use your calculator to work out $\sqrt[3]{5\tan 60° + 1}$
Write down all the figures on your calculator display.

2.129754359

(2)

(Total for Question 7 is 3 marks)

8 Make t the subject of $p = \sqrt{a + \frac{t}{2}}$

$p^2 = a + \frac{t}{2}$

$p^2 - a = \frac{t}{2}$

$2(p^2 - a) = t$

or $t = 2p^2 - 2a$

$t = 2(p^2 - a)$

(Total for Question 8 is 3 marks)

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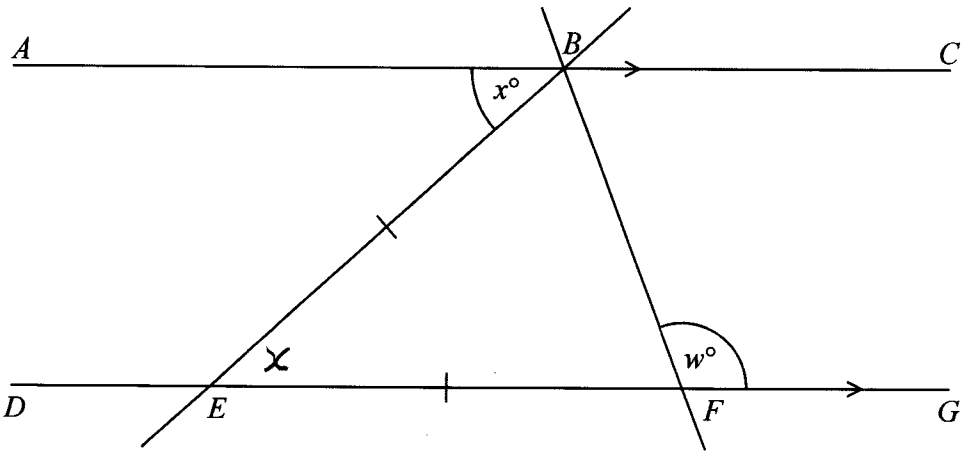
9



In the diagram ABC and $DEFG$ are parallel lines.
Angle $ABE = x°$
$EB = EF$

Show that $w = 90 + \frac{1}{2}x$

Give a reason for each stage of your working.

$\angle BEF = x$ (alternate angles equal)

$\angle EFB = \frac{180 - x}{2}$ (base $\angle$s of isos $\triangle$)

$\angle BFG = w = 180 - \left(\frac{180 - x}{2}\right)$ ($\angle$s on str line add up to 180°)

$w = 180 - \frac{180}{2} + \frac{x}{2}$

$w = 180 - 90 + \frac{x}{2}$

$w = 90 + \frac{x}{2}$

(Total for Question 9 is 4 marks)

10 In 2016 the population of the UK was 6.5×10^7

Laura wants to calculate an estimate for the population of the UK in 2020
She assumes that the population increases by 0.6% each year.

(a) Using Laura's assumption, calculate an estimate for the population of the UK in 2020

$6.5 \times 10^7 \times 1.006^4$

$= 6.66 \times 10^7$

6.66×10^7

(2)

Kieran also assumes that the population of the UK increases by 0.6% each year.

He says that it will take over 80 years for the population to increase by 50% because $\frac{50}{0.6} = 83.\dot{3}$

Kieran's method is wrong.

(b) Explain what is wrong with his method.

Growth is compound $1.006^{83} = 1.64$

Population would grow 64% in 83 years

(1)

Assuming that the population of the UK increases by 0.6% each year,

(c) show that the population of the UK each year forms a geometric progression.

Terms are generated by multiplying previous term by 1.006 each year

This forms a geometric progression with $r = 1.006$

(2)

(Total for Question 10 is 5 marks)

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11 Anna and Bill share some money in the ratio 2 : 5

Anna gets £A
Bill gets £B

Carl and Donna share twice as much money as Anna and Bill share.
They share the money in the ratio 3 : 1

Carl gets £C
Donna gets £D

Find $A : B : C : D$
Give your answer in its simplest form.

2 + 5 = 7 shares
3 + 1 = 4 shares
LCM of 7 and 4
= 28

A : B
= 2 : 5
= 4 : 10
= 6 : 15
= 8 : 20
28 shares

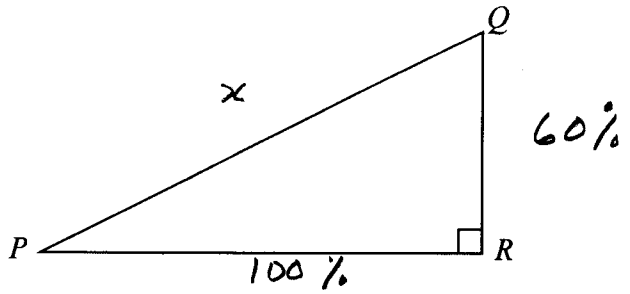
C : D
= 3 : 1
= 6 : 2
= 21 : 7
= 42 : 14
56 shares

A : B : C : D
= 8 : 20 : 42 : 14
= 4 : 10 : 21 : 7

A : B : C : D
= 4 : 10 : 21 : 7

(Total for Question 11 is 3 marks)

12 Here is triangle PQR.



The length of QR is 60% of the length of PR.

Find the value of sin QPR.
Give your answer correct to 3 significant figures.

$\tan \angle PQR = \frac{60}{100} = 0.6$

$\angle PQR = \tan^{-1} 0.6$

$= 30.96^{0}$

$\sin \angle PQR = 0.514$

OR

$x^2 = 60^2 + 100^2$

$x^2 = 13600$

$x = 116.619$

$\sin \angle PQR = \frac{60}{116.619} = 0.514$

0.514

(Total for Question 12 is 3 marks)

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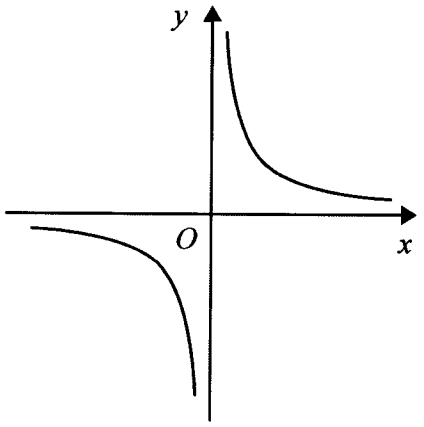
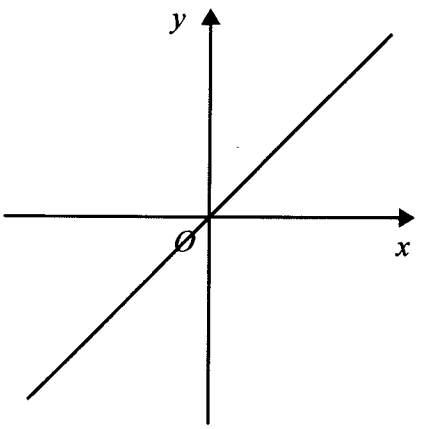
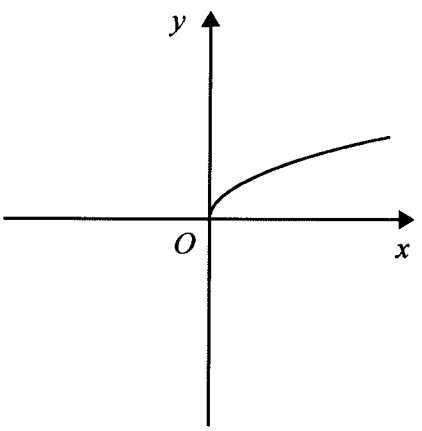
13 Here are five graphs.
Each graph shows either direct proportion or inverse proportion.



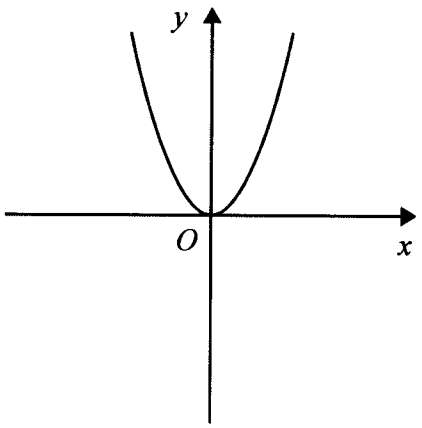
A



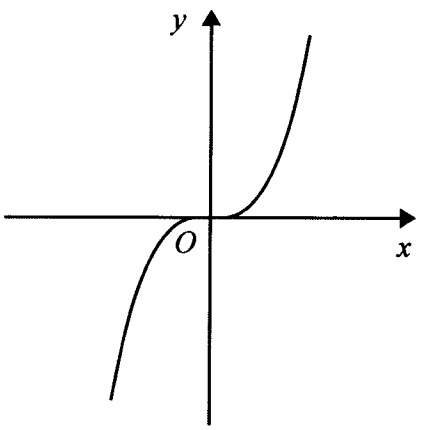
B



C



D



E

The table shows five equations.

Equation	Graph
$y = kx^3$	E
$y = k\sqrt{x}$	C
$y = kx^2$	D
$y = \frac{k}{x}$	A
$y = kx$	B

Match the letter of each graph to its equation.

(Total for Question 13 is 3 marks)

14 A cafe owner sells 10 different types of sandwich.

Rayheem buys a different type of sandwich on Monday, on Tuesday and on Wednesday.

In how many ways can he do this?

$10 \times 9 \times 8 = 720$

720

(Total for Question 14 is 2 marks)

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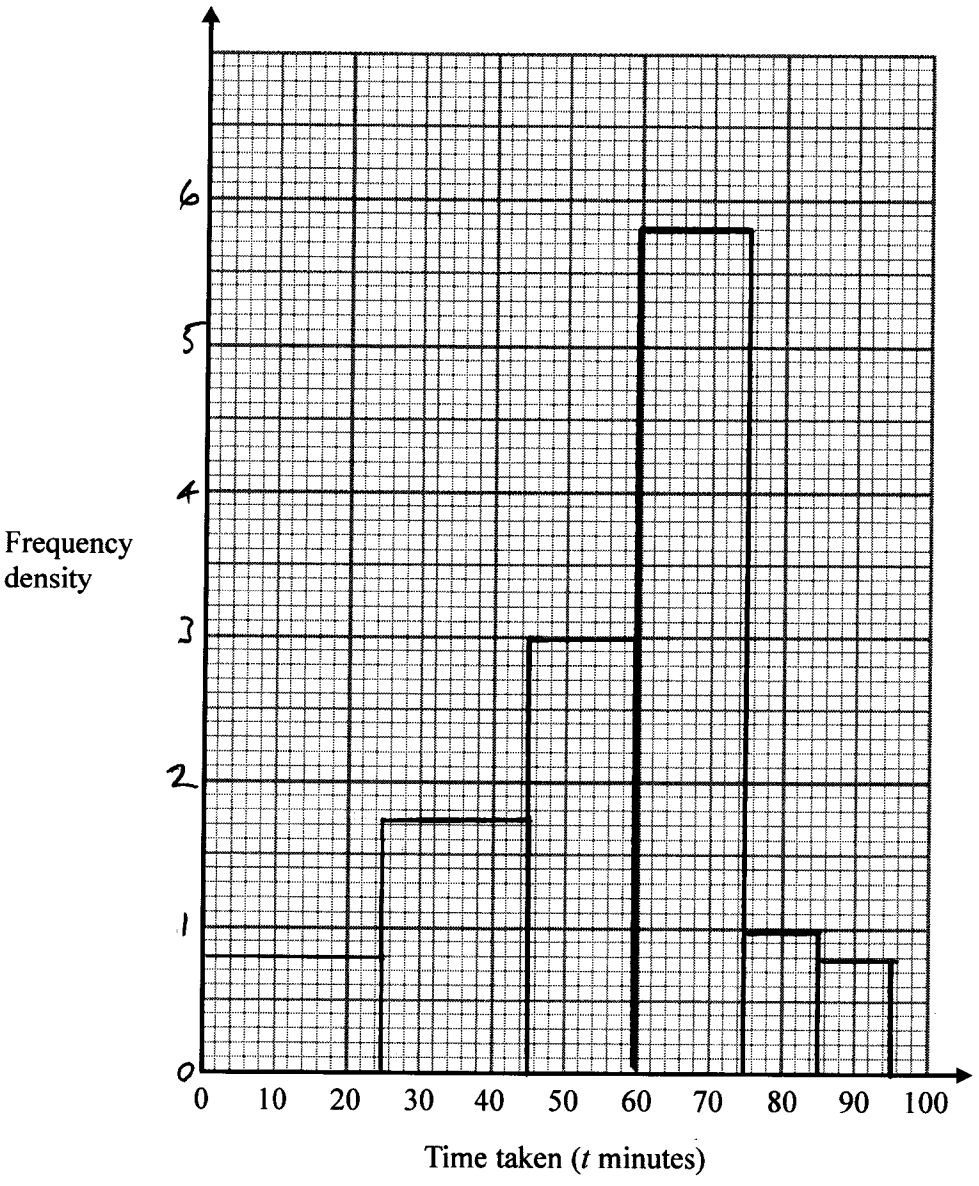
15 The table shows information about the times a group of students took to do a park run.

Time taken (t minutes)	Frequency	FREQ	DENSITY
$0 < t \leqslant 25$	20	20/25	0.8
$25 < t \leqslant 45$	35	35/20	1.75
$45 < t \leqslant 60$	45	45/15	3.0
$60 < t \leqslant 75$	87	87/15	5.8
$75 < t \leqslant 85$	10	10/10	1.0
$85 < t \leqslant 95$	8	8/10	0.8

Draw a histogram for this information.



(Total for Question 15 is 3 marks)

16 (a) Show that the equation $x^3 - 3x^2 + 3 = 0$ has a solution between $x = 2$ and $x = 3$

$x = 2 \quad 2^3 - 3(2)^2 + 3 = 8 - 12 + 3 = -1$

$x = 3 \quad 3^3 - 3(3)^2 + 3 = 27 - 27 + 3 = +3$

Change in sign between $x = 2$ and $x = 3$

Continuous function so root exists between $x = 2$ and $x = 3$

(2)

(b) Show that the equation $x^3 - 3x^2 + 3 = 0$ can be rearranged to give $x = \sqrt[3]{3x^2 - 3}$

$x^3 = 3x^2 - 3$

$x = \sqrt[3]{3x^2 - 3}$

(1)

(c) Starting with $x_0 = 2$, use the iteration formula $x_{n+1} = \sqrt[3]{3x_n^2 - 3}$ to find the value of x_2
Give your answer correct to 3 decimal places.

$x_0 = 2$

$x_1 = \sqrt[3]{3 \times 2^2 - 3} = 2.08008$

$x_2 = \sqrt[3]{3 \times 2.08008^2 - 3} = 2.153015$

$x_2 = 2.153$ to 3 d.p

2.153

(3)

(Total for Question 16 is 6 marks)

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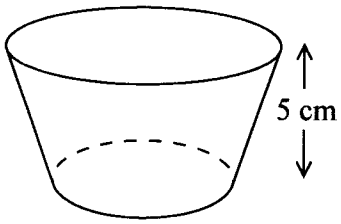
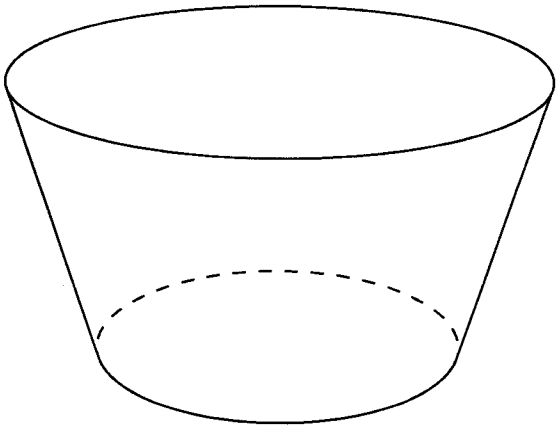
17 A factory makes ice cream tubs in two sizes, small and large.



small



large

The tubs are similar in shape.

The height of the small tub is 5 cm

The volume of the small tub is 150 cm^3
The volume of the large tub is 500 cm^3

Work out the height of the large tub.
Give your answer correct to 3 significant figures.

Vol = 150 : 500
= 15 : 50
= 3 : 10
Height = $3\sqrt{3}$: $3\sqrt{10}$

Height of large tub

$= 5 \times \frac{3\sqrt{10}}{3\sqrt{3}} = 7.469$ cm

= 7.47 cm to 3s.f

7.47 cm

(Total for Question 17 is 2 marks)

18 $(x - 8)(x + 4) = (x - a)^2 + b$ for all values of x.

Find the value of a and the value of b.

$(x-8)(x+4) = x^2 - 8x + 4x - 32$

$= x^2 - 4x - 32$

$= (x-2)^2 - 32 - 4$

$= (x-2)^2 - 36$

$a =$ 2

$b =$ −36

(Total for Question 18 is 3 marks)

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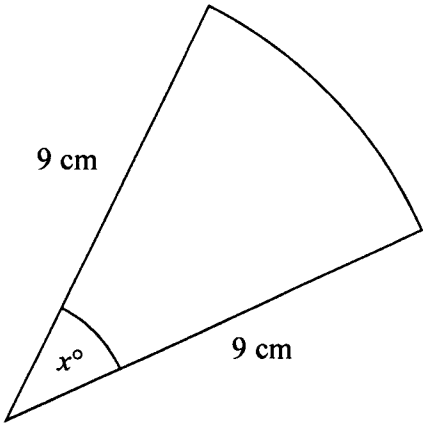
19 The diagram shows a sector of a circle of radius 9 cm.



The sector has a perimeter of 25 cm.

Work out the value of x.
Give your answer correct to 1 decimal place.

$$\frac{x}{360} \times 2 \times \pi \times 9 + 9 + 9 = 25$$

$$\frac{x}{360} \times 18\pi = 25 - 9 - 9$$

$$\frac{\pi x}{20} = 7$$

$$\pi x = 7 \times 20$$

$$x = \frac{140}{\pi}$$

$$x = 44.6^\circ \quad \text{to 1 d.p.}$$

44.6°

(Total for Question 19 is 4 marks)

20 $m = \dfrac{1}{ps}$

$p = 5.37$ correct to 2 decimal places.
$s = 2.9$ correct to 1 decimal place.

$5.365 \leq p < 5.375$

$2.85 \leq s < 2.95$

Calculate the upper bound for the value for m.
You must show your working.

upper bound for m when p, s are smallest

$$m \leq \frac{1}{(5.365 \times 2.85)}$$

$m \leq 0.0654$ to 3 s.f.

upper bound 0.0654

(Total for Question 20 is 3 marks)

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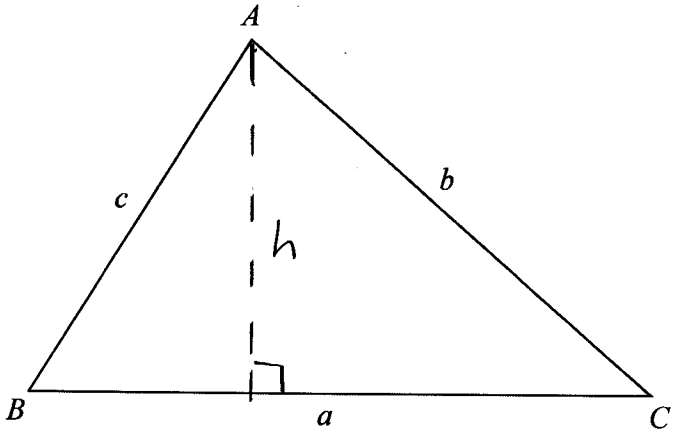
21 The diagram shows an acute-angled triangle ABC.



Prove that area of triangle $ABC = \frac{1}{2}ab\sin C$

Let height as shown be h

Area $= \frac{\text{base} \times \text{height}}{2} = \frac{ah}{2}$

but $\sin C = \frac{h}{b}$

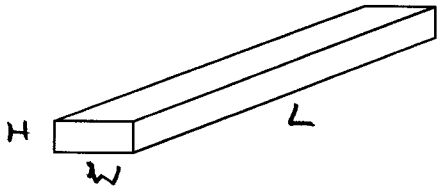
so $b\sin C = h$ ∴ substituting for h

Area $= \frac{ab\sin C}{2}$

(Total for Question 21 is 3 marks)

22 A solid cuboid has a volume of 40 cm^3
The cuboid has a total surface area of 100 cm^2
One edge of the cuboid has length 2 cm.

Find the length of a diagonal of the cuboid.
Give your answer correct to 3 significant figures.



$LWH = 40\ cm^3$

$2LW + 2LH + 2HW = 100\ cm^2$

Say $H = 2$ $\quad 2LW = 40$

$LW = 20$ $\quad \Rightarrow W = \frac{20}{L}$

$2LW + 4L + 4W = 100$

$40 + 4L + 4\left(\frac{20}{L}\right) = 100$

$\div 4$ $\quad 10 + L + \frac{20}{L} = 25$

$L + \frac{20}{L} = 15$

$L^2 + 20 = 15L$

$L^2 - 15L + 20 = 0$

$L = \frac{15 \pm \sqrt{(-15)^2 - 4 \times 1 \times 20}}{2} = \frac{15 \pm \sqrt{145}}{2}$

$L = 13.521$ or 1.479

W

Diagonal $= \sqrt{L^2 + W^2 + H^2}$

$= \sqrt{13.521^2 + 1.479^2 + 2^2}$

$= 13.7479$ $\quad 13.7$ ..... cm

(Total for Question 22 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS

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