Please check the examination details below before entering your candidate information

Candidate surname		Other names

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

Centre Number

Candidate Number

Thursday 7 November 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **1MA1/2H**

Mathematics

Paper 2 (Calculator)
Higher Tier

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 ▶

P58874A0124

Pearson

Answer ALL questions.

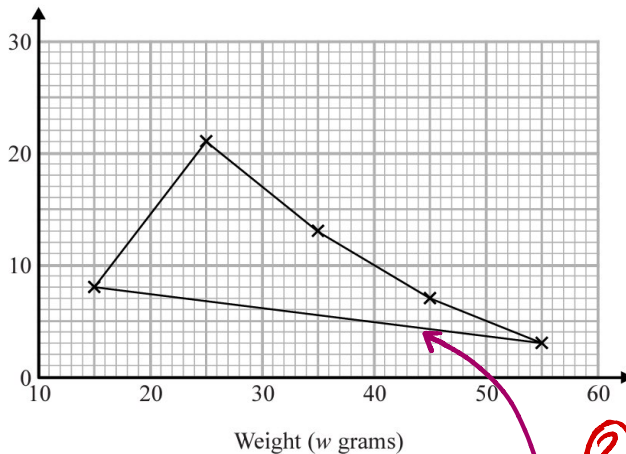**Write your answers in the spaces provided.**

You must write down all the stages in your working.

1   The table shows some information about the weights of 50 potatoes.

Weight (w grams)	Frequency
$10 < w \leqslant 20$	6
$20 < w \leqslant 30$	21
$30 < w \leqslant 40$	13
$40 < w \leqslant 50$	7
$50 < w \leqslant 60$	3

Iveta drew this frequency polygon for the information in the table.
The frequency polygon is **not** fully correct.

Weight (w grams)

Write down **two** things that are wrong with the frequency polygon.

1 Haven't labled the y axis

2 Polygon should not be closed i·e this bottom line shouldn't be here

3. Point (15, 6) plotted incorrectly

only need ② to write 2 errors

(Total for Question 1 is 2 marks)

2 The length of a pencil is 128 mm correct to the nearest millimetre.

Complete the error interval for the length of the pencil.

127.5 mm $\leqslant$ length $<$ **128.5** mm

(Total for Question 2 is 2 marks)

3 Tom and Adam have a total of 240 stamps.
The ratio of the number of Tom's stamps to the number of Adam's stamps is 3 : 7

Tom buys some stamps from Adam.
The ratio of the number of Tom's stamps to the number of Adam's stamps is now 3 : 5

How many stamps does Tom buy from Adam?
You must show all your working.

	Tom : Adam
Original	3 : 7 — Total 240 stamps
New	3 : 5 — Total 240 stamps

Seeing how many stamps Tom had originally and after the sale

Original → 3 + 7 = 10 $\frac{240}{10} = 24$ 3 × 24 = 72 stamps

New → 3 + 5 = 8 $\frac{240}{8} = 30$ 3 × 30 = 90 stamps

getting how many stamps '1' in the ratio is worth

90 − 72 = 18

Finding how many stamps were sold

18

(Total for Question 3 is 4 marks)

P 5 8 8 7 4 A 0 3 2 4

4 Each person in a fitness club is going to get a free gift.
Stan is going to order the gifts.

Stan takes a sample of 50 people in the fitness club.
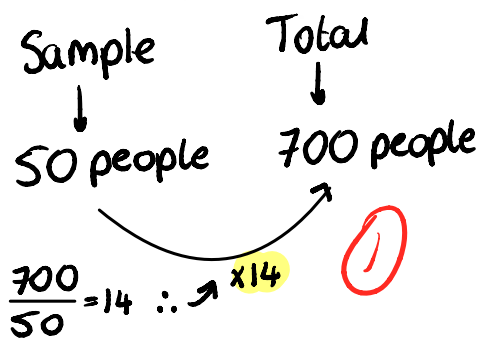He asks each person to tell him the gift they would like.

The table shows information about his results.

Gift	Number of people
sports bag	17
gym towel	7
headphones	11
voucher	15

$17 \times 14 = 238$

There are 700 people in the fitness club.

(i) Work out how many sports bags Stan should order.

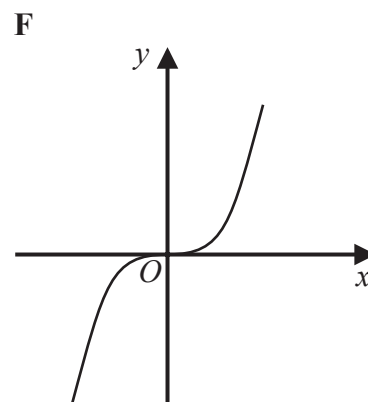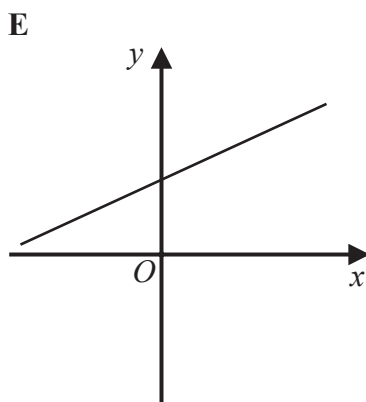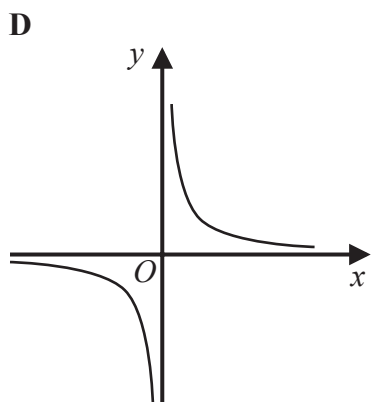Sample → 50 people   Total → 700 people
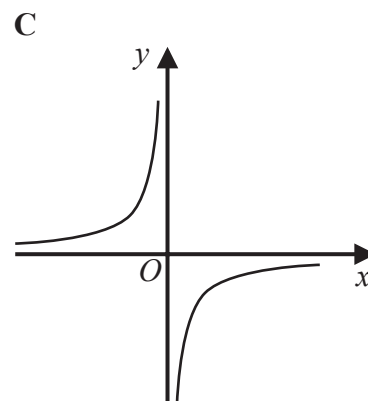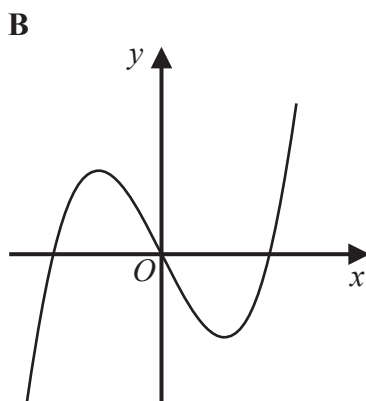
$\frac{700}{50} = 14$ ∴ ↗ ×14

238

(2)

(ii) Write down any assumption you made **and** explain how this could affect your answer.

We've assumed the sample is representative

(1)

5 Here are six graphs.

A

B

C

D

E

F
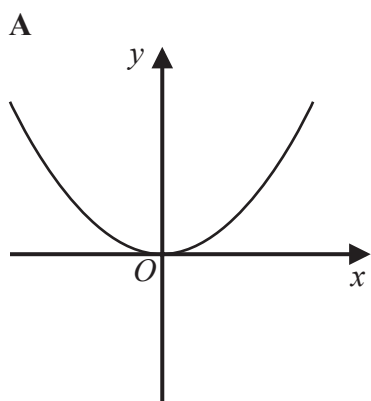
Write down the letter of the graph that could have the equation

(a) $y = x^3$

...........F........... ①

(1)

(b) $y = \dfrac{1}{x}$

...........D........... ①

(1)

(Total for Question 5 is 2 marks)

6 The *n*th term of a sequence is $2n^2 - 1$

The *n*th term of a different sequence is $40 - n^2$

Show that there is only one number that is in both of these sequences.

	$n=1$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$	$n=7$
$2n^2-1$	1	7	17	31	49	71	97
$40-n^2$	39	36	31	24	15	4	-9

③

clear that
as these sequences
continue they
won't cross again

7 Work out $(3.42 \times 10^{-7}) \div (7.5 \times 10^{-6})$
Give your answer in standard form.

$$\frac{a^x}{a^y} = a^{x-y}$$

$$\frac{3.42 \times 10^{-7}}{7.5 \times 10^{-6}} = 0.456 \times \frac{10^{-7}}{10^{-6}} = 0.456 \times 10^{-7-(-6)} = 0.456 \times 10^{-7+6}$$

①

$$= 0.456 \times 10^{-1} = 4.56 \times 10^{-2}$$

①

$$4.56 \times 10^{-2}$$

8 The number of days, d, that it will take to build a house is given by

$$d = \frac{720}{n}$$

where n is the number of workers used each day.

Ali's company will take 40 days to build the house.
Hayley's company will take 30 days to build the house.

Hayley's company will have to use more workers each day than Ali's company.

How many more?

Ali's Company: $n \times 40 = \frac{720 \times n}{n}$

$\frac{40n}{40} = \frac{720}{40}$

$n = 18$

Hayley's Company: $n \times 30 = \frac{720 \times n}{n}$ ①

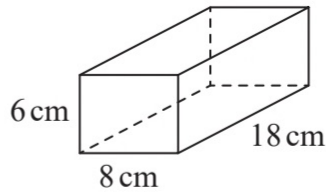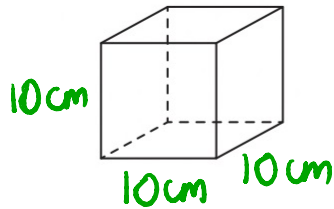$\frac{30n}{30} = \frac{720}{30}$

$n = 24$

$24 - 18 = 6$ ①

① 6

(Total for Question 8 is 3 marks)

P 5 8 8 7 4 A 0 7 2 4

9   The diagram shows a cube and a cuboid.

10 cm
10 cm 10 cm

6 cm
18 cm
8 cm

The total surface area of the cube is equal to the total surface area of the cuboid.

Janet says,

"The volume of the cube is equal to the volume of the cuboid."

Is Janet correct?
You must show how you get your answer.

SA cuboid: $6 \times 8 = 48 \text{ cm}^2$
                  $6 \times 18 = 108 \text{ cm}^2$
                  $8 \times 18 = 144 \text{ cm}^2$

        $48 + 108 + 144 = 300 \text{ cm}^2$ ①

        $300 \times 2 = 600 \text{ cm}^2$ ①

Area of each face in cube must be the same

∴ area of one face $= \dfrac{600}{6} = 100 \text{ cm}^2$

Length of each side in cube must be the same

Since area $= 100 \text{ cm}^2$ each length must be 10 cm ①
                              (because $10 \times 10 = 100$)

Volume of cube: $10 \times 10 \times 10 = 1000 \text{ cm}^3$ ← Volume $= h \times w \times d$

volume of cuboid: $6 \times 8 \times 18 = 864 \text{ cm}^3$ ①

No Janet is not correct since $1000 \neq 864$ ①

10 Make k the subject of the formula $y = \sqrt{2m - k}$

$y = \sqrt{2m - k}$

$y^2 = 2m - k$ ①
$+k \qquad +k$

$y^2 + k = 2m$
$-y^2 \qquad -y^2$

$k = 2m - y^2$

$k = 2m - y^2$ ①

(Total for Question 10 is 2 marks)

P 5 8 8 7 4 A 0 9 2 4

11 Megan grows potatoes.

The box plot below shows information about the weights of Megan's potatoes.

57

Megan

Median

20   30   40   50   60   70   80
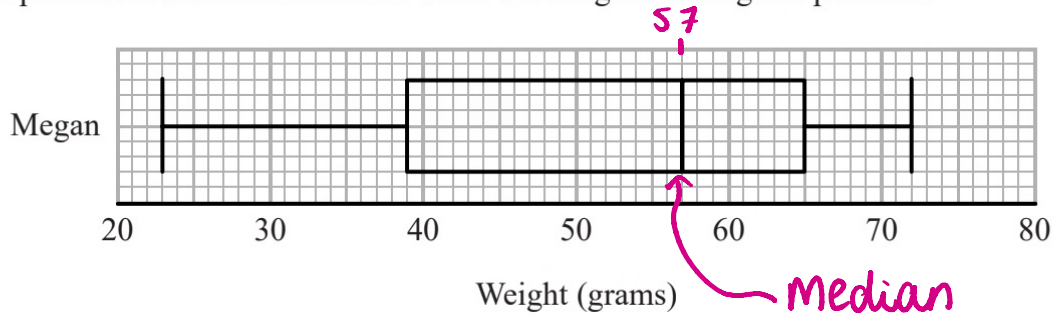
Weight (grams)

Megan says that half of her potatoes weigh less than 50 grams each.
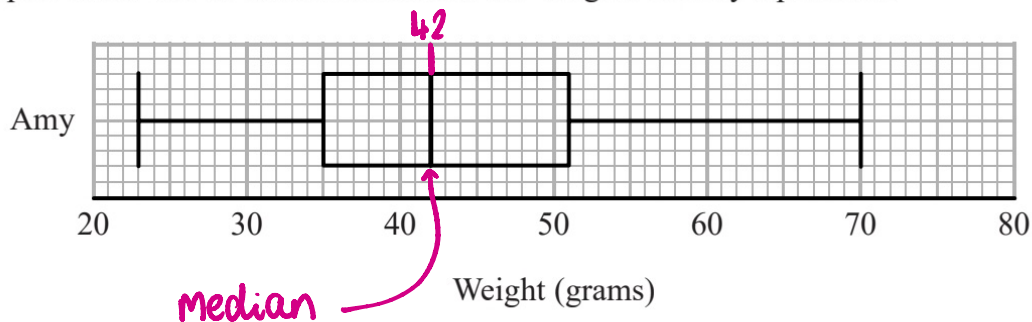
(a) Is Megan correct?
Give a reason for your answer.

No Since the median is 57 ①

(1)

Amy also grows potatoes.

The box plot below shows information about the weights of Amy's potatoes.

42

Amy

median

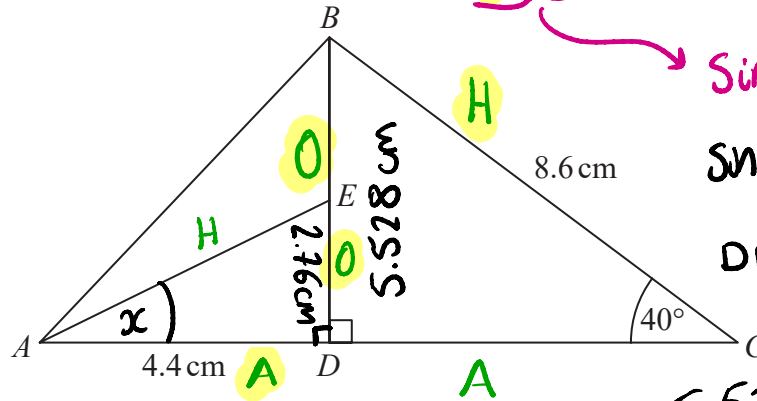20   30   40   50   60   70   80

Weight (grams)

(b) Compare the distribution of the weights of Megan's potatoes with the distribution of the weights of Amy's potatoes.

The median weight of Amy's potatoes is less than Megans ①

The interquartile range of weights for Megan was greater than the interquartile range of weights for Amy ①

(2)

12 The diagram shows triangle *ABC*.

SOHCAHTOA

$\sin\theta = \frac{O}{H}$

$\sin 40 = \frac{DB}{8.6}$ ①

$DB = \sin 40 \times 8.6$
$= 5.52797\ldots$

$ED = \frac{5.52797\ldots}{2} = 2.76\ldots$ ①

$\tan\theta = \frac{O}{A}$

$\tan x = \frac{2.76\ldots}{4.4}$ ①

$x = \tan^{-1}\left(\frac{2.76\ldots}{4.4}\right)$

$x = 32.1 \ (1dp)$ ①

ADC and *DEB* are straight lines.

AD = 4.4 cm
BC = 8.6 cm
E is the midpoint of *DB*.

Angle *CDB* = 90°
Angle *DCB* = 40°

Work out the size of angle *EAD*.
Give your answer correct to 1 decimal place.
You must show all your working.

.... °

(Total for Question 12 is 4 marks)

13 Sakira invested £3550 in a savings account for 3 years.

She was paid 2.6% per annum compound interest for each of the first 2 years.
She was paid $R\%$ interest for the third year.

Sakira had £3819.21 in her savings account at the end of the 3 years.

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

102.6%
$\qquad \Big) \div 100$
1.026

$3550 \times 1.026^2 \times x = 3819.21$ ①

$3736.9998 \, x = 3819.21$

① $\quad x = \dfrac{3819.21}{3736.9998}$

$x = 1.021998\ldots$

$1.021998\ldots$
$102.1998\ldots \Big) \times 100$

$102.1998\ldots - 100 = 2.1998\ldots = 2.2\% \ (1dp)$ ①

14 Sadia is going to buy a new car.
For the car, she can choose one body colour, one roof colour and one wheel type.

She can choose from

19 different body colours
25 different wheel types   *x different roof colours*

The total number of ways Sadia can choose the body colour and the roof colour and the wheel type is 3325

Work out the number of different roof colours that Sadia can choose from.

$$\frac{19 \times 25 \times x}{19 \times 25} = \frac{3325}{19 \times 25} \quad ①$$

$$x = \frac{3325}{475} = 7$$

① 7

(Total for Question 14 is 2 marks)

15 Expand and simplify $(3x + 2)(2x + 1)(x - 5)$

$$(3x+2)(2x+1)(x-5) \quad ①$$

$$(6x^2+3x+4x+2)(x-5)$$

$$(6x^2+7x+2)(x-5) \quad ①$$

$$6x^3+7x^2+2x-30x^2-35x-10$$

$$6x^3-23x^2-33x-10$$

① $6x^3-23x^2-33x-10$

(Total for Question 15 is 3 marks)

P 5 8 8 7 4 A 0 1 3 2 4

16

Marek has 9 cards.
There is a number on each card.

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

Marek takes at random two of the cards.
He works out the product of the numbers on the two cards.

Work out the probability that the product is an even number.

Odd × odd = odd
Odd × even = even
even × even = even

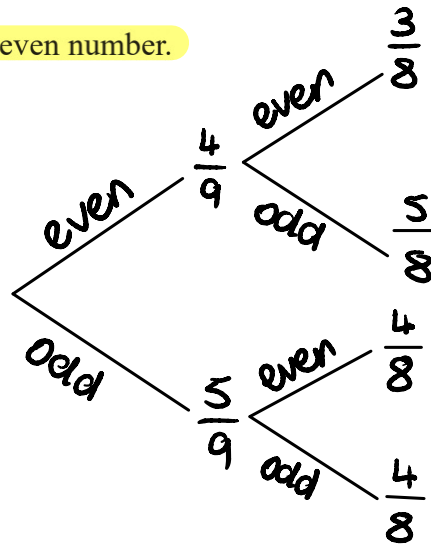For 'And' use ×
For 'Or' use +

even and even
$$\frac{4}{9} \times \frac{3}{8} = \frac{1}{6}$$

odd and even
$$\frac{5}{9} \times \frac{4}{8} = \frac{5}{18}$$ ①

even and odd
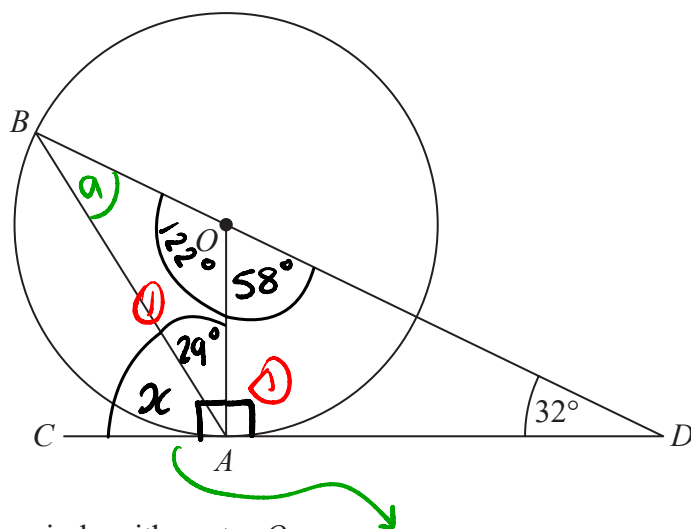$$\frac{4}{9} \times \frac{5}{8} = \frac{5}{18}$$

$$\frac{1}{6} + \frac{5}{18} + \frac{5}{18} = \frac{13}{18}$$ ① 'OR' the possibilities

$$\frac{13}{18}$$ ①

17

A and B are points on a circle with centre O.
CAD is the tangent to the circle at A.
BOD is a straight line.

Angle $ODA = 32°$

Work out the size of angle CAB.
You must show all your working.

$x + 29 = 90$

$x = 90 - 29$

$x = 61°$

Since sum of all interior angles in a triangle = $180°$

Angle $AOD = 180 - 90 - 32 = 58°$

Since angles on a straight line add to $180°$

Angle $AOB = 180 - 58 = 122°$

Since we know triangle AOB is isosceles since OA and OB are the same length
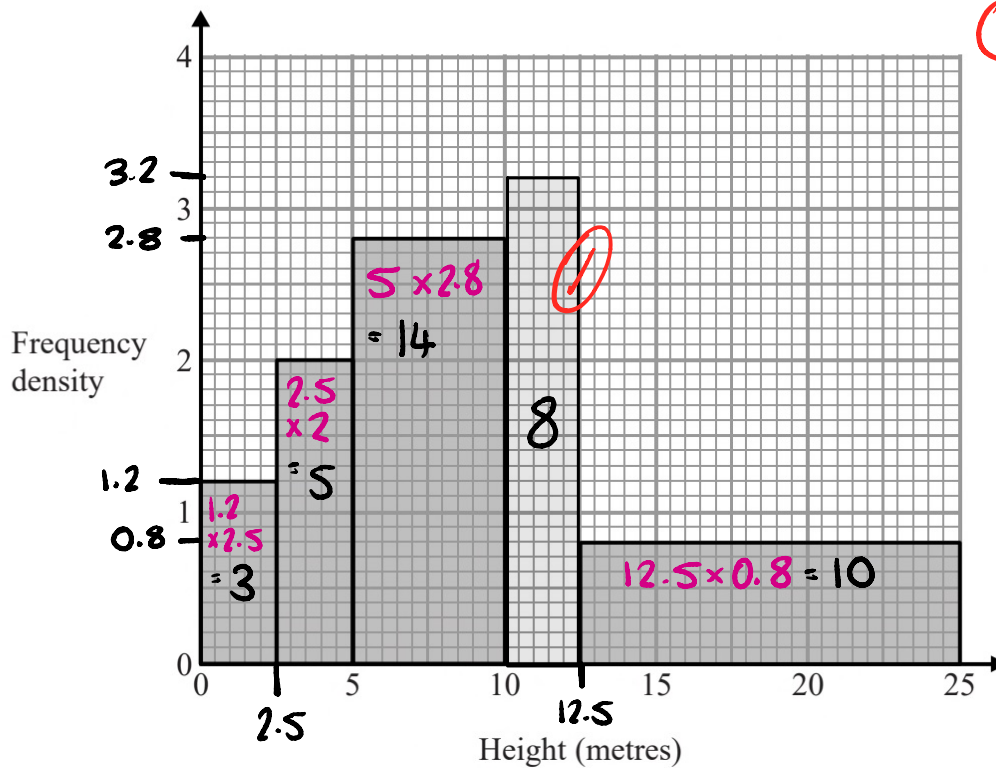
$2a + 122 = 180$

$2a = 180 - 122$

$a = \frac{1}{2}(180 - 122) = 29$

61 °

(Total for Question 17 is 3 marks)

Turn over ▶

18

The histogram gives information about the heights, in metres, of the trees in a park.
The histogram is incomplete.

① Finding Frequencies

Frequency density (y-axis), Height (metres) (x-axis)

5 × 2·8 = 14

① (circled)

2·5 × 2 = 5

1·2 × 2·5 = 3

8

12·5 × 0·8 = 10

25 − 12·5 = 12·5

2·5

12·5

20% of the trees in the park have a height between 10 metres and 12.5 metres.
None of the trees in the park have a height greater than 25 metres.

Complete the histogram.
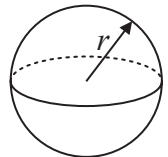
Frequency Density between 10m and 12.5m
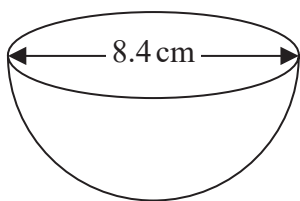
$$3 + 5 + 14 + 10 = 80\%$$

① $32 = 80\%$

$\div 8 \quad 4 = 10\%$ $\quad \div 8$

$\times 2 \quad 8 = 20\%$ $\quad \times 2$

$$2.5 \times x = 8$$
$\div 2.5$ $\qquad \div 2.5$

$$x = \frac{8}{2.5} = 3.2$$

19 The diagram shows a hemisphere with diameter 8.4 cm.

8.4 cm

Volume of sphere $= \dfrac{4}{3}\pi r^3$

Work out the volume of the hemisphere.
Give your answer correct to 3 significant figures.

$d = 2r \Rightarrow r = \dfrac{d}{2}$

$r = \dfrac{8.4}{2} = 4.2\,cm$

Volume of sphere $= \dfrac{4}{3}\pi(4.2)^3 = 98.784\pi\,cm^3$ ①

Volume of hemisphere $= \dfrac{1}{2} \times 98.784\pi$
$= 155.16954... = 155\ (3sf)$ ①

..................**155**.......... cm³

(Total for Question 19 is 2 marks)

20 $d = \dfrac{1}{8}c^3$

$c = 10.9$ correct to 3 significant figures.

By considering bounds, work out the value of d to a suitable degree of accuracy.
Give a reason for your answer.

① $10.85 \le C < 10.95$

let $C = 10.85$ (lower bound)
① $d = \dfrac{1}{8}(10.85)^3 = 159.66...$

let $C = 10.95$ (upper bound)
$d = \dfrac{1}{8}(10.95)^3 = 164.11...$ ①

both these values round to 160 (3sf)
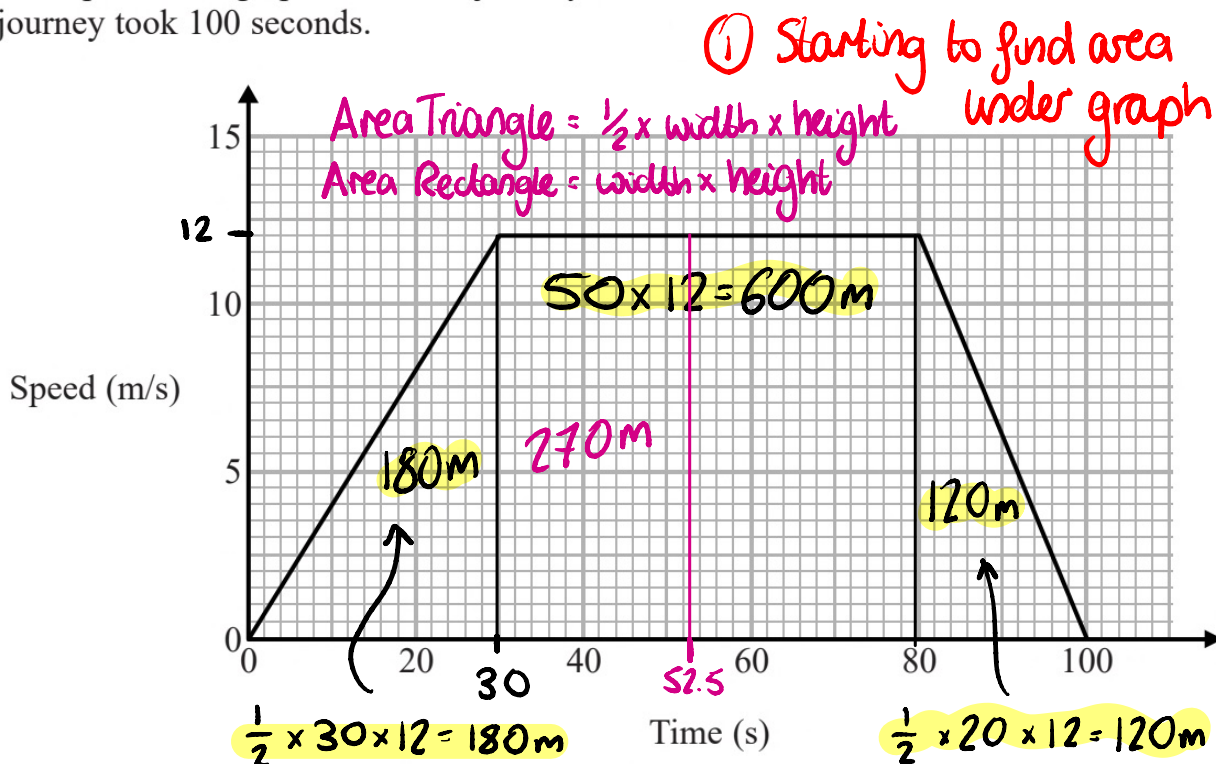$\therefore d \approx 160$ ①

(Total for Question 20 is 4 marks)

Turn over ▶

21 Here is a speed-time graph for a train journey between two stations.
The journey took 100 seconds.

① Starting to find area under graph

Area Triangle = ½ × width × height
Area Rectangle = width × height

50 × 12 = 600m

180m 270m

120m

½ × 30 × 12 = 180m

½ × 20 × 12 = 120m

Speed (m/s)

Time (s)

52.5

(a) Calculate the time taken by the train to travel half the distance between the two stations.
You must show all your working.

For speed-time graph distance is the area under the graph

180 + 600 + 120 = 900m ①

$\frac{900}{2}$ = 450m

450 − 180 = 270m

$x × 12 = 270$
÷12   ÷12

$x = 22.5$ ①

30 + 22.5 = 52.5s ①

(b) Compare the acceleration of the train during the first part of its journey with the
acceleration of the train during the last part of its journey.

During first part acceleration is positive but last part is
negative (deceleration) OR Acceleration is greater during
the last part than the first part ①

22 The number of rabbits on a farm at the end of month n is P_n

The number of rabbits at the end of the next month is given by $P_{n+1} = 1.2P_n - 50$

At the end of March there are 200 rabbits on the farm.

(a) Work out how many rabbits there will be on the farm at the end of June.

March $\quad n=1 \quad P_1 = 200 \qquad -10$

April $\qquad n=2 \quad P_2 = 1.2(200) - 50 = 190$ ① $\quad -12$

May $\qquad n=3 \quad P_3 = 1.2(190) - 50 = 178$ ① $\quad -15$

June $\qquad n=4 \quad P_4 = 1.2(178) - 50 = 163.6 \quad \therefore 163$ rabbits ①

163

(3)

(b) Considering your results in part (a), suggest what will happen to the number of rabbits on the farm after a long time.
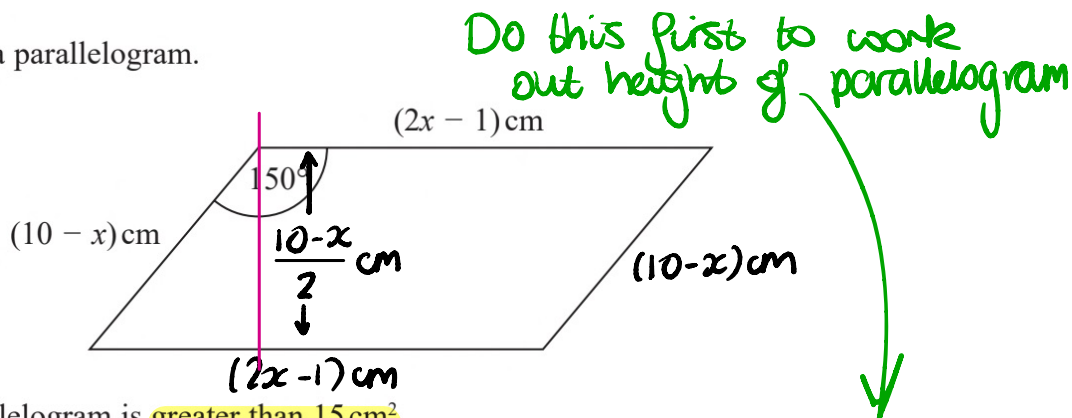
There won't be any rabbits ①

Since number decreases more + more each year as seen above

(1)

(Total for Question 22 is 4 marks)

P 5 8 8 7 4 A 0 1 9 2 4

23

The diagram shows a parallelogram.

Do this first to work out height of parallelogram

$(2x - 1)\,\text{cm}$

$150°$

$(10 - x)\,\text{cm}$

$\dfrac{10-x}{2}$ cm

$(10-x)\,\text{cm}$

$(2x-1)\,\text{cm}$

The area of the parallelogram is greater than 15 cm²

(a) Show that $2x^2 - 21x + 40 < 0$

$150 - 90 = 60$

SOHCAHTOA

$\cos\theta = \dfrac{a}{h}$

$(10-x)\,\text{cm}$ $60°$

h a

O

$\cos 60° = \dfrac{a}{10-x}$

$\dfrac{(10-x) \times 1}{2} = \dfrac{a \times (10-x)}{10-x}$

$a = \dfrac{10-x}{2}$

Area parallelogram = base × height

①

$\text{Area} = (2x-1) \times \dfrac{10-x}{2}$

$= \dfrac{(2x-1)(10-x)}{2}$

$= \dfrac{20x - 2x^2 - 10 + x}{2}$

① $= \dfrac{-2x^2 + 21x - 10}{2}$

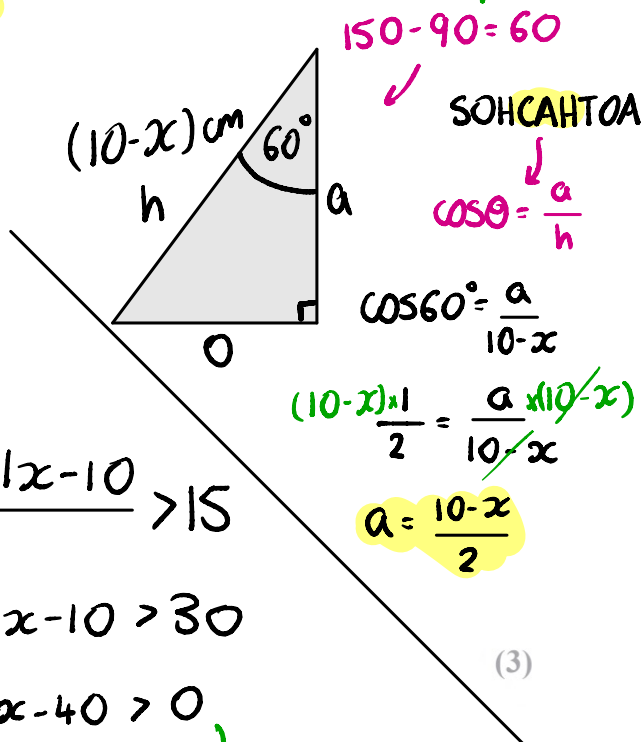$\dfrac{-2x^2 + 21x - 10}{2} > 15$

$-2x^2 + 21x - 10 > 30$

$-2x^2 + 21x - 40 > 0$

$\times -1$ $\times -1$ ①

$2x^2 - 21x + 40 < 0$

Flip inequality when multiply by -1

(3)

(b) Find the range of possible values of x.

$$2x^2 - 21x + 40 < 0 \quad ①$$

$$(2x-5)(x-8) < 0$$

$$(2x-5)(x-8) = 0$$

$$2x-5 = 0 \qquad x-8 = 0$$
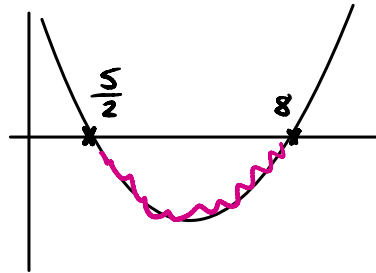$$2x = 5 \qquad\qquad x = 8$$
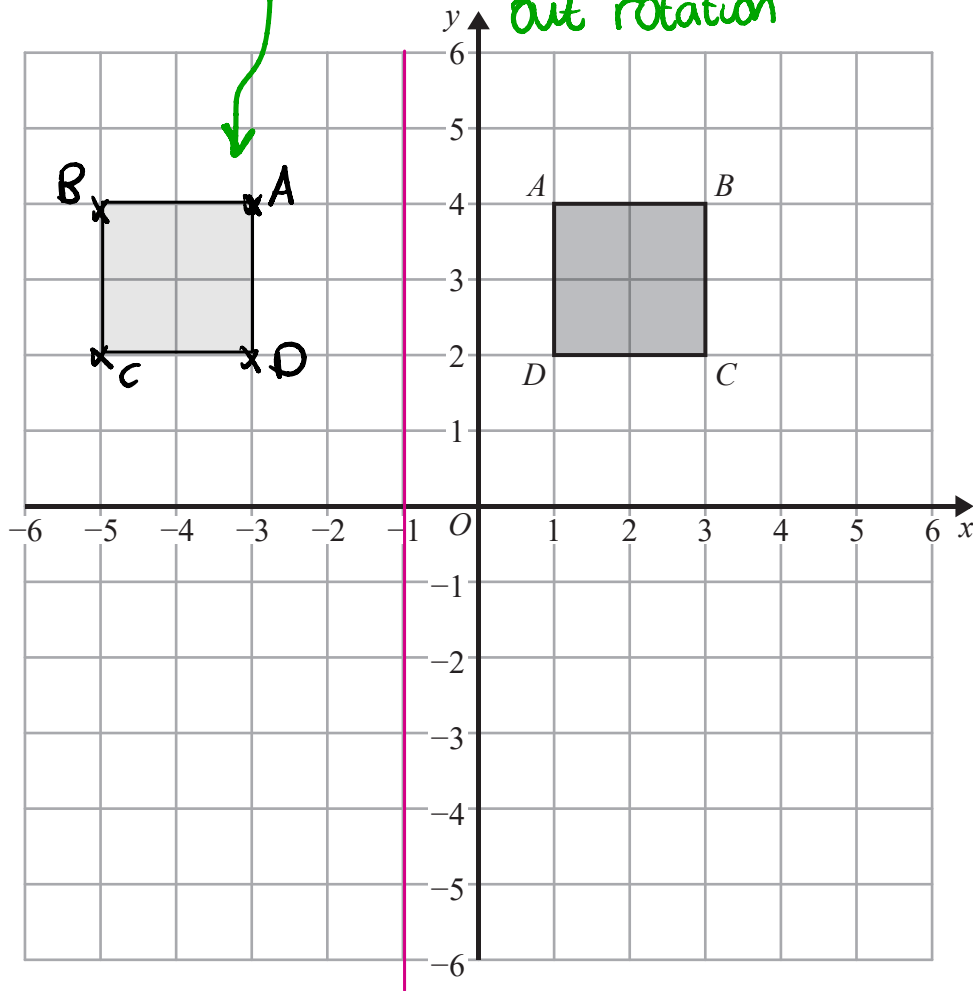$$x = \frac{5}{2} \quad ①$$

$$\frac{5}{2} < x < 8 \quad ①$$

(3)

24

Once done reflection use tracing paper to work out rotation

Square *ABCD* is transformed by a combined transformation of a reflection in the line $x = -1$ followed by a rotation.

Under the combined transformation, two vertices of the square *ABCD* are invariant.

Describe fully one possible rotation.

Rotation about (-1,0) 90° clockwise ②

(Total for Question 24 is 2 marks)

P 5 8 8 7 4 A 0 2 1 2 4

25 The straight line **L** has equation $3x + 2y = 17$

The point A has coordinates $(0, 2)$
The straight line **M** is perpendicular to **L** and passes through A.

Line **L** crosses the y-axis at the point B. ← B is y intercept
Lines **L** and **M** intersect at the point C.

Work out the area of triangle ABC.
You must show all your working.

$3x + 2y = 17$
$-3x \qquad -3x$

$y = mx + c$ ← y intercept
         ↳ gradient

$\dfrac{2y}{2} = \dfrac{17 - 3x}{2}$

$y = \dfrac{17}{2} - \dfrac{3}{2}x$ ↙ line L

$y = \dfrac{-3}{2}x + \dfrac{17}{2}$ ①

STEP 1

If lines are perpendicular their gradients are negative reciprocals of each other

Gradient of line L is $\dfrac{-3}{2}$

∴ the gradient of M is $\dfrac{2}{3}$ ①

We know M goes through
$x = 0$ and $y = 2$
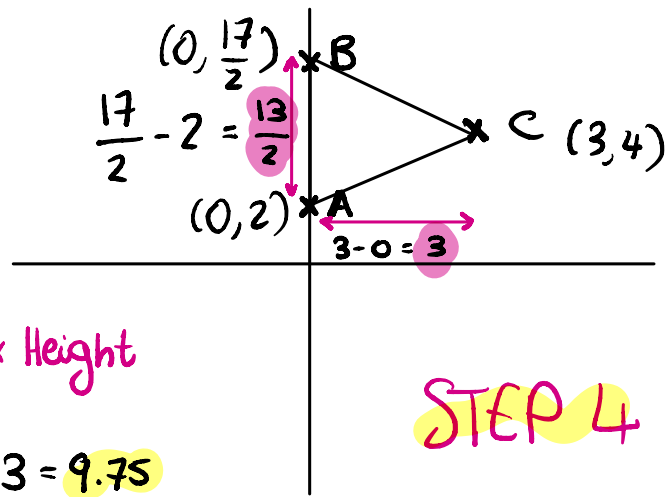
Using general equation
of a line → $y - y_1 = M(x - x_1)$

$y - 2 = \dfrac{2}{3}(x - 0)$
$\quad +2 \qquad +2$

$y = \dfrac{2}{3}x + 2$ ← line M

STEP 2

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①

Point B is $\left(0, \dfrac{17}{2}\right)$

$\dfrac{-3}{2}x + \dfrac{17}{2} = \dfrac{2}{3}x + 2$
$\quad \dfrac{-17}{2} \qquad\qquad \dfrac{-17}{2}$

$\dfrac{-3}{2}x = \dfrac{2}{3}x - \dfrac{13}{2}$
$\dfrac{-2}{3}x \qquad \dfrac{-2}{3}x$

$\dfrac{-13}{6}x = -\dfrac{13}{2}$
$\left(x \dfrac{-6}{13}\right) \qquad \left(x \dfrac{-6}{13}\right)$

$x = 3$

$y = \dfrac{2}{3}(3) + 2$
$\quad = \dfrac{6}{3} + 2$
$\quad = 2 + 2 = 4$

$y = 4$

∴ Point C is $(3, 4)$
STEP 3 ①

Point A is $(0, 2)$
Point B is $\left(0, \frac{17}{2}\right)$
Point C is $(3, 4)$

$(0, \frac{17}{2})$ ✕ B

$\frac{17}{2} - 2 = \frac{13}{2}$

$(0, 2)$ ✕ A

✕ C $(3, 4)$

$3 - 0 = 3$

Area Triangle $= \frac{1}{2} \times$ Base $\times$ Height

Area Triangle ABC $= \frac{1}{2} \times \frac{13}{2} \times 3 = 9.75$

①

STEP 4

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