LPGS GCSE Mock 2 Paper 2

HIGHER TIER

Wednesday 26th February 2020 AFTERNOON

Name LJH

Maths Teacher Worked Solutions

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.

TOTAL MARK out 80 _____

Answer ALL questions.

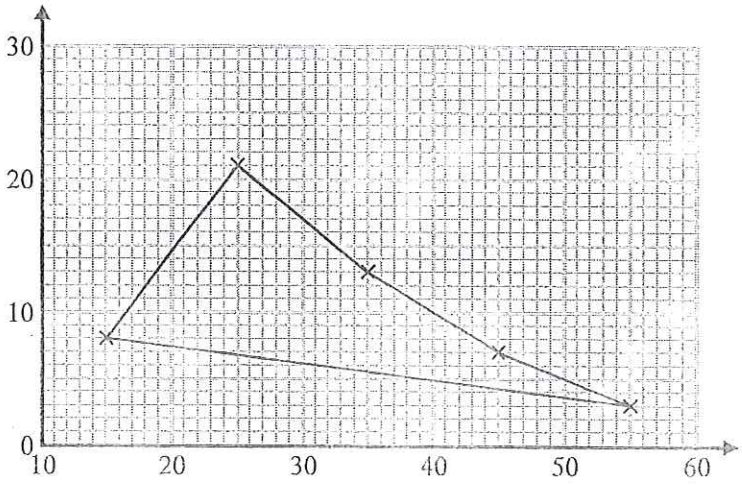
Write your answers in the spaces provided.

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.



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

1 The start and finish of the polygon should not be joined

2 The vertical axis is not labelled

(Total for Question 1 is 2 marks)

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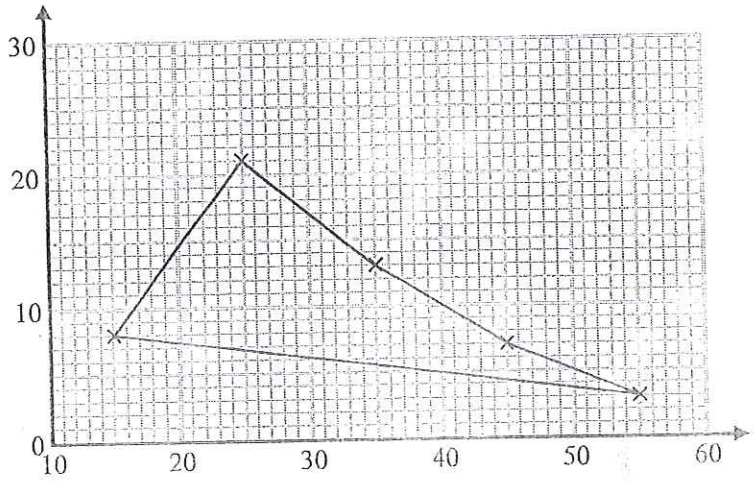


Write down **two** things that are wrong with the frequency polygon.

1 The start and finish of the polygon should not be joined

2 The vertical axis is not labelled

(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.

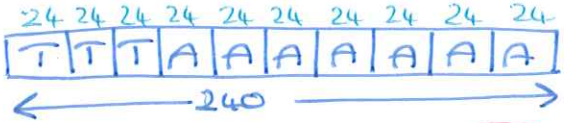
127.5 mm ⩽ length < 128.5 mm

(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

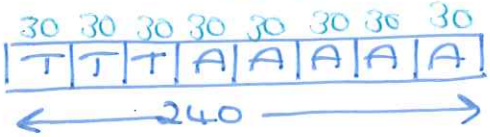
How many stamps does Tom buy from Adam?
You must show all your working.



240 ÷ 10 = 24

Tom has 3 × 24 = 72 stamps
Adam has 7 × 24 = 168 stamps

Tom buys some stamps from Adam



240 ÷ 8 = 30

Tom has 3 × 30 = 90 stamps
Adam has 5 × 30 = 150 stamps

Tom has increased from 72 to 90 stamps
so he bought 18 stamps from Adam

18

(Total for Question 3 is 4 marks)

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

There are 700 people in the fitness club.

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

$\frac{17}{50} \times 700$

238

(2)

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

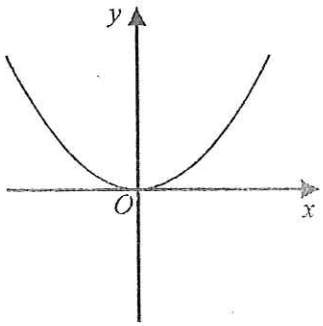
The 50 people in the sample are representative of all members of the club. If not then there may be bias meaning that significantly more or less sports bags may be required.

(1)

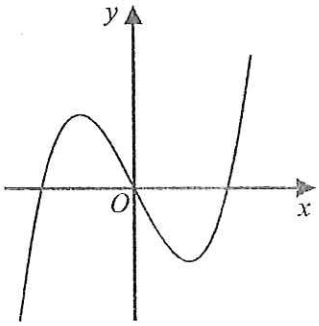
(Total for Question 4 is 3 marks)

5 Here are six graphs.

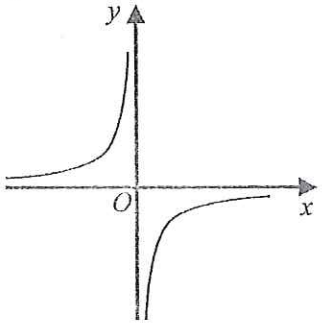
A



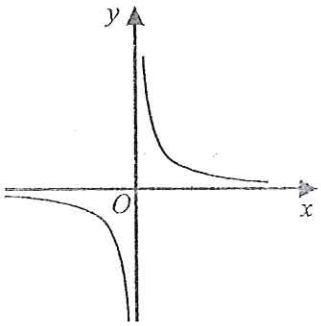
B



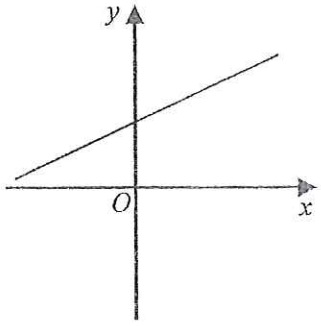
C



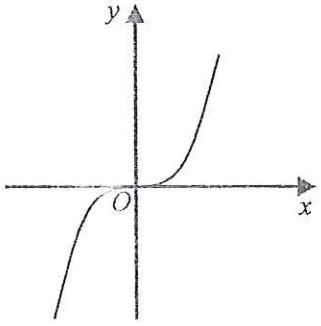
D



E



F



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

(a) $y = x^3$

F

(1)

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

D

(1)

(Total for Question 5 is 2 marks)

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

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

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

$2n^2 - 1 = 40 - n^2$ $[+n^2$

$3n^2 - 1 = 40$ $[+1$

$3n^2 = 41$

doesn't solve to give whole number value of n

$2n^2 - 1$

1, 7, 17, (31), 49, ... ascending

$40 - n^2$

39, 36, (31), 24, ... descending

31 is the only number that is in both sequences

(Total for Question 6 is 3 marks)

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

$= 0.0456$

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

(Total for Question 7 is 2 marks)

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.

Ali $d = 40$
Hayley $d = 30$

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

How many more?

Ali's company

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

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

$= 18$ workers

Hayley's company

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

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

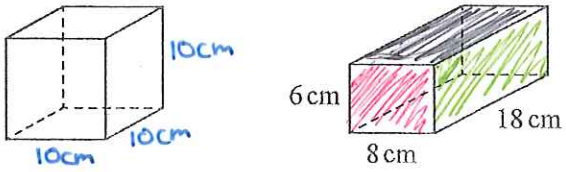
$= 24$ workers

Hayley's company will use 6 more workers than Ali's company.

6

(Total for Question 8 is 3 marks)

9 The diagram shows a cube and a cuboid.



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.

Surface Area cuboid

$= 2 \times (6\text{cm} \times 8\text{cm}) + 2 \times (6\text{cm} \times 18\text{cm}) + 2 \times (8\text{cm} \times 18\text{cm})$

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

$= 600\text{cm}^2$

Surface Area Cube

$= 600\text{cm}^2$

$\therefore$ each face is $\frac{600\text{cm}^2}{6} = 100\text{cm}^2$

$\therefore$ side length of cube $= 10\text{cm}$

Volume Cube

$= 10\text{cm} \times 10\text{cm} \times 10\text{cm}$

$= 1000\text{cm}^3$

Volume Cuboid

$= 6\text{cm} \times 8\text{cm} \times 18\text{cm}$

$= 864\text{cm}^3$

Janet is not correct

(Total for Question 9 is 5 marks)

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

[square

$y^2 = 2m - k$

[+k

$y^2 + k = 2m$

[$-y^2$

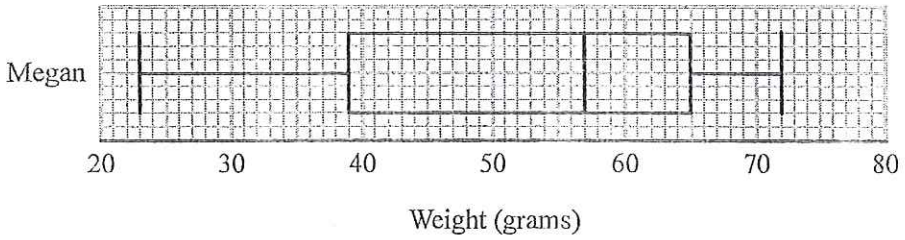
$k = 2m - y^2$

$k = 2m - y^2$

(Total for Question 10 is 2 marks)

11 Megan grows potatoes.

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



Megan says that half of her potatoes weigh less than 50 grams each.

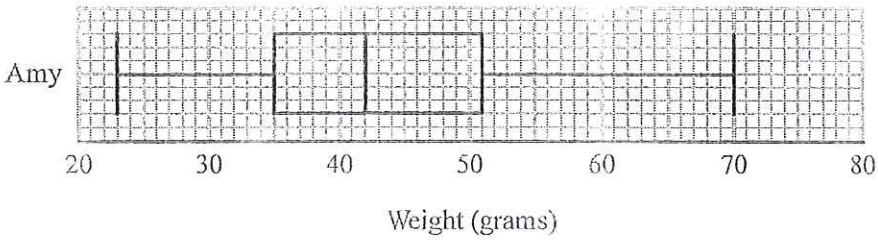
(a) Is Megan correct?
Give a reason for your answer.

no. the median is 57 grams which means half of her potatoes weigh less than 57 grams, not 50 grams.

(1)

Amy also grows potatoes.

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



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

Compare medians

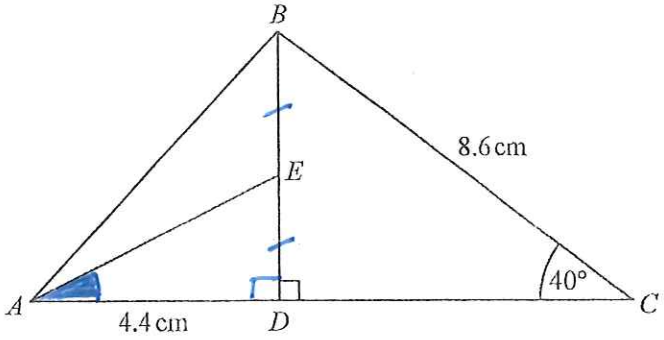
- The median weight of Megan's potatoes is 57 grams which is higher than the median weight of Amy's potatoes 42 grams. Megan's potatoes are heavier on average than Amy's potatoes.

Compare IQR

- The IQR of Megan's potatoes is larger than IQR of Amy's potatoes suggesting that Amy's potatoes are a more consistent weight than Megan's potatoes.

(Total for Question 11 is 3 marks)

12 The diagram shows triangle *ABC*.



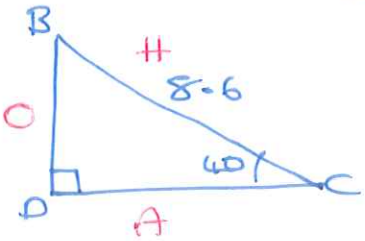
ADC and *DEB* are straight lines.

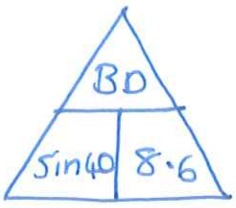
AD = 4.4 cm
BC = 8.6 cm
E is the midpoint of *DB*.

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.

Step 1
Find side BD using triangle BCD SOH CAH TOA

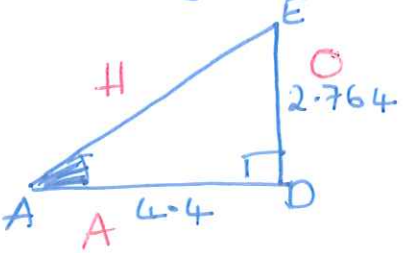


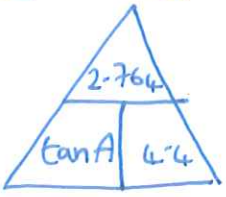


BD = sin(40) × 8.6
= 5.527973 cm

this means that side ED = $\frac{1}{2}$ BD
= 2.7639867 cm

Step 2
Find angle EAD using triangle ADE SOH CAH TOA





$\tan A = \frac{2.764}{4.4}$

$A = \tan^{-1}\left(\frac{2.764}{4.4}\right)$

= 32.1 (1dp)°

(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.

£3550 × 1.026^2 = £3736.9998
after 2 years

£3736.9998 (after 2 years) —×?→ £3819.21 (after 3 years)

$\frac{3819.21}{3736.9998} = 1.02199898 4$

interest rate in 3rd year

$R = (1.02199 - 1) \times 100$
$= 2.2\%$ (1dp)

(Total for Question 13 is 3 marks)

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

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

let x = number different roof colours

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

choices = no° body colours × no° wheel types × no° roof colours

$3325 = 19 \times 25 \times x$

$3325 = 475 \times x$

$475x = 3325$

$x = 7$

7

(Total for Question 14 is 2 marks)

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

$(3x+2)(2x+1)$

$= 6x^2 + 3x + 4x + 2$

$= 6x^2 + 7x + 2$

$(x-5)(6x^2+7x+2)$

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

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

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

(Total for Question 15 is 3 marks)

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.

Even × Even = Even
Even × Odd = Even
Odd × Odd = Odd

×	1	2	3	4	5	6	7	8	9
1	X	2	3	4	5	6	7	8	9
2	2	X	6	8	10	12	14	16	18
3	3	6	X	12	15	18	21	24	27
4	4	8	12	X	20	24	28	32	36
5	5	10	15	20	X	30	35	40	45
6	6	12	18	24	30	X	42	48	54
7	7	14	21	28	35	42	X	56	63
8	8	16	24	32	40	48	56	X	72
9	9	18	27	36	45	54	63	72	X

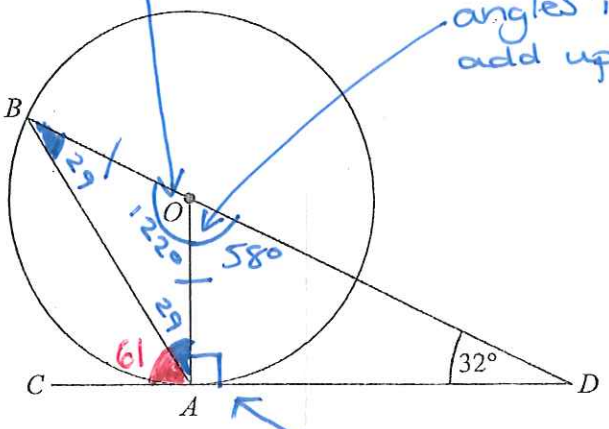
sample space

number possible outcomes 72
number even products 52
number odd products 20

P(product even) = $\frac{52}{72}$ or $\frac{13}{18}$

(Total for Question 16 is 3 marks)

17



angles on a straight line add up to 180°

angles in a triangle add up to 180°

Base angles in isosceles triangles are equal

BO = AO radii of circle

when a radius and tangent meet they make a right angle

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.

$C\hat{A}B = 180° - 29° - 90°$

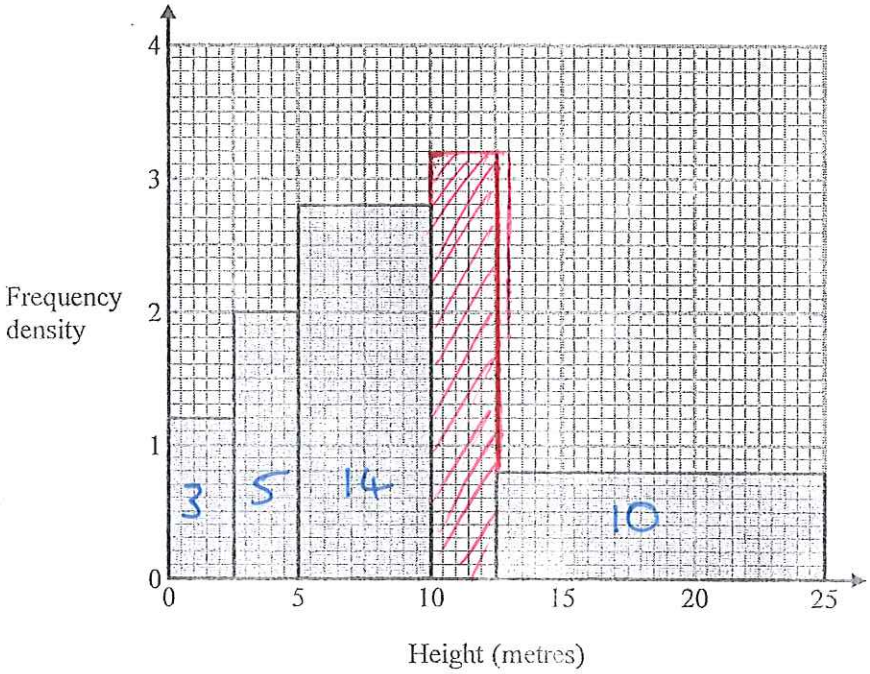
$= 61°$

angles on a straight line add up to 180°

61 °

(Total for Question 17 is 3 marks)

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



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.

$0 \rightarrow 2.5$m
frequency $= 2.5 \times 1.2$
$= 3$ trees

$2.5 \rightarrow 5$m
frequency $= 2.5 \times 2$
$= 5$ trees

$5 \rightarrow 10$m
frequency $= 5 \times 2.8$
$= 14$ trees

$12.5 \rightarrow 25$m
frequency $= 12.5 \times 0.8$
$= 10$ trees

32 trees are 80% of the trees in the park

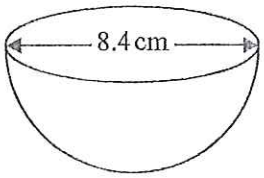
80% : 32 trees (÷8)
10% : 4 trees (×2)
20% : 8 trees

$10 \rightarrow 12.5$m
frequency $= 8$
class width $= 2.5$

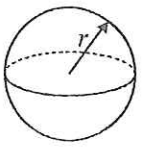
frequency density $= \frac{\text{frequency}}{\text{class width}}$
$= \frac{8}{2.5}$
$= 3.2$

(Total for Question 18 is 3 marks)

19 The diagram shows a hemisphere with diameter 8.4 cm.



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



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

$d = 8.4$
$r = 4.2$

Volume hemisphere $= \frac{1}{2} \times \frac{4}{3} \times \pi \times (4.2)^3$

$= 155.1695443$
$= 155 \text{ cm}^3$ (3sf)

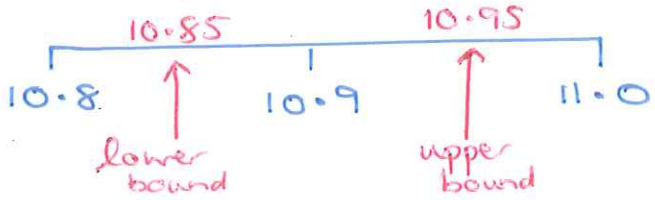
155 ..... cm^3

(Total for Question 19 is 2 marks)

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

$c = 10.9$ 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.



lower bound $d = \frac{1}{8} \times (10.85)^3 = 159.6611406$

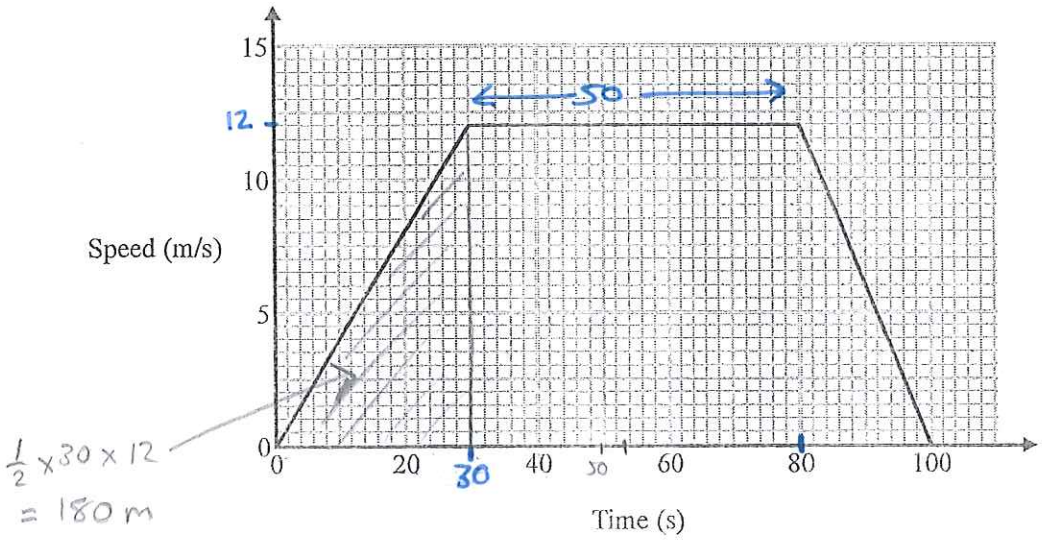
upper bound $d = \frac{1}{8} \times (10.95)^3 = 164.1165469$

lower bound = 160 (2sf)
upper bound = 160 (2sf)
these agree to 2sf

$d = 160$ (2sf)

(Total for Question 20 is 4 marks)

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



$\frac{1}{2} \times 30 \times 12$
$= 180\text{ m}$

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

Distance travelled = Area under graph
Area trapezium $= \frac{1}{2}(100 + 50) \times 12$
$= 900\text{ m}$

need to find time taken to travel 450 m

0 → 30 seconds (area of triangle) 180m
450m − 180m = 270m ← how much of rectangle makes this?

$\frac{270}{12} = 22.5$ seconds

$30 + 22.5$

52.5 seconds
(4)

(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.

In the first part of the journey the acceleration is positive but in the last part it is negative which means it is decelerating.
OR/ acceleration is greater during the last part as the line has a steeper gradient.
(1)

(Total for Question 21 is 5 marks)

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 $P_1 = 200$

April $P_2 = 1.2 \times 200 - 50$
$= 190$

May $P_3 = 1.2 \times 190 - 50$
$= 178$

June $P_4 = 1.2 \times 178 - 50$
$= 163.6$

$\therefore$ 163 rabbits

Answer 163 or 164 accepted

(3)

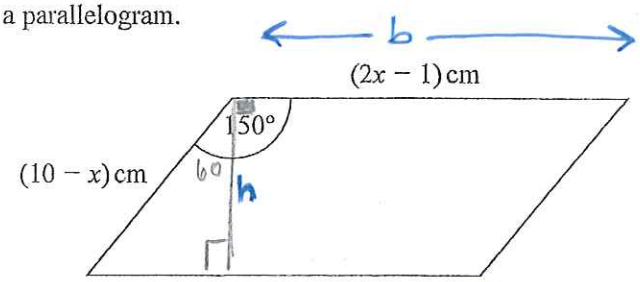
(b) Considering your results in part (a), suggest what will happen to the number of rabbits on the farm after a long time.

after a long time there will be no rabbits left on the farm

(1)

(Total for Question 22 is 4 marks)

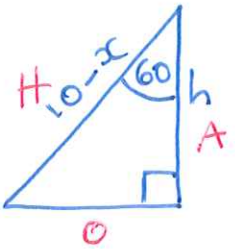
23 The diagram shows a parallelogram.

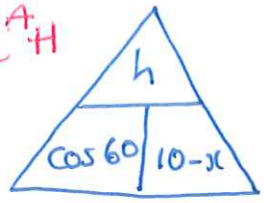


The area of the parallelogram is greater than 15 cm²

Area parallelogram = base × perpendicular height

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





$h = \cos(60) \times (10 - x)$
$= \frac{1}{2} \times (10 - x)$

Area parallelogram

$(2x - 1) \times \frac{1}{2} \times (10 - x) > 15$

$\frac{(2x-1)(10-x)}{2} > 15$

$(2x-1)(10-x) > 30$

$20x - 2x^2 - 10 + x > 30$ [x-1]

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

$2x^2 - 21x + 40 < 0$ (3)

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

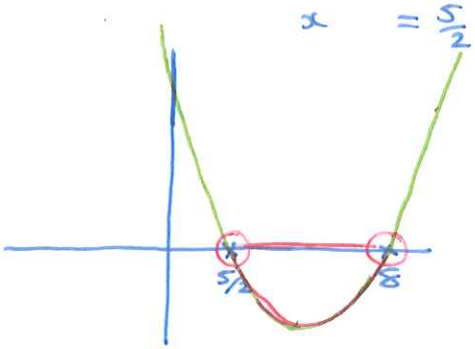
Solve $2x^2 - 21x + 40 < 0$

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

key values $2x - 5 = 0$ $x - 8 = 0$

$2x = 5$ $x = 8$

$x = \frac{5}{2}$



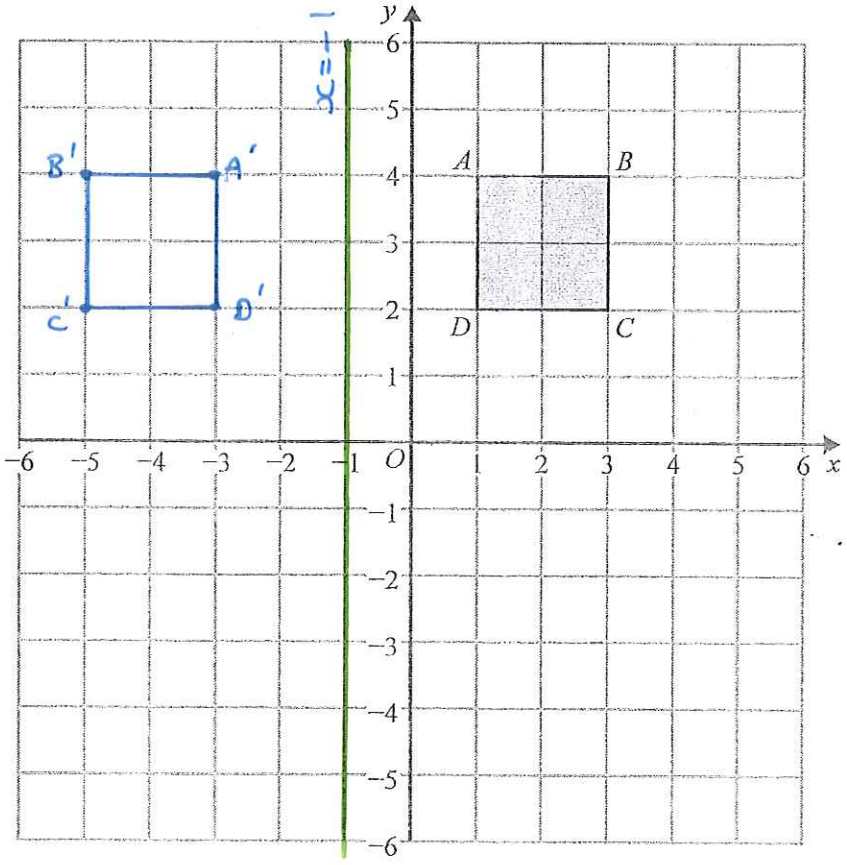
$\frac{5}{2} < x < 8$

.....

(3)

(Total for Question 23 is 6 marks)

24



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. (unchanged)

Describe fully one possible rotation.

rotation 90° clockwise about (−1, 0)

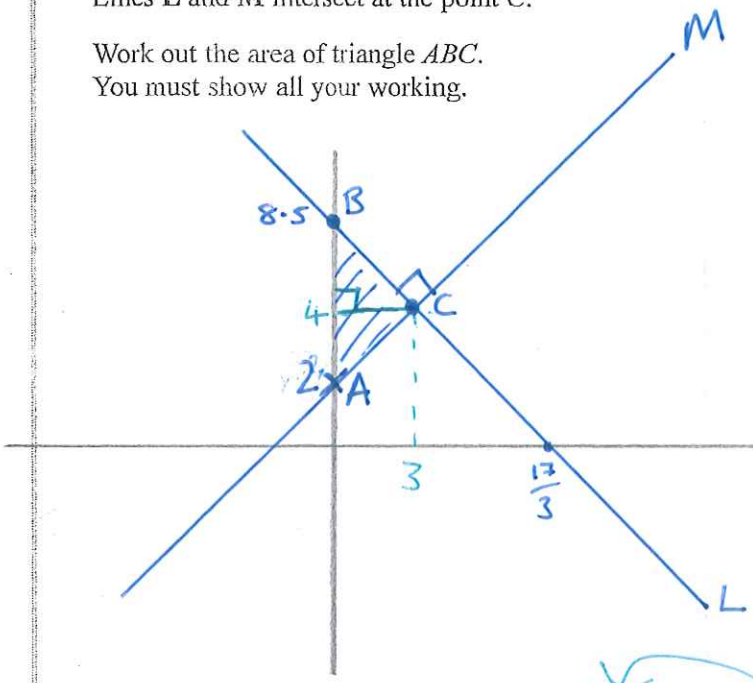
(Total for Question 24 is 2 marks)

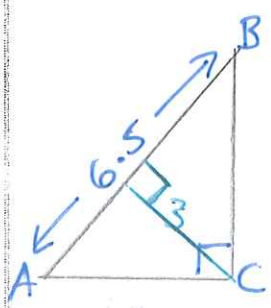
25 The straight line **L** has equation $3x + 2y = 17$

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.
Lines **L** and **M** intersect at the point C.

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





Area triangle ABC
$= \frac{1}{2} \times 6.5 \times 3$
$= 9.75$ units^2

Line L

$3x + 2y = 17$

$2y = 17 - 3x$

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

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

point B

$x = 0, y = \frac{17}{2} = 8.5$

Line M

$y = mx + c$

gradient $m = \frac{2}{3}$

point $x = 0, y = 2$

$2 = \frac{2}{3}(0) + c$

$2 = c$

∴ Line m has equation

$y = \frac{2}{3}x + 2$

Point C

$-\frac{3}{2}x + \frac{17}{2} = \frac{2}{3}x + 2$

$\frac{13}{2} = \frac{13}{6}x$ $\quad x = 3$

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

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS