OCR
Oxford Cambridge and RSA

H

Thursday 05 November 2020 – Morning

GCSE (9–1) Mathematics

J560/05 Paper 5 (Higher Tier)

Time allowed: 1 hour 30 minutes

You can use:
- geometrical instruments
- tracing paper

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

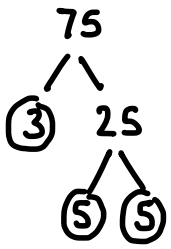
INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **100**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

1 Write 75 as a product of its prime factors.



3 x 5 x 5 ..... **[2]**

2 **(a)** Solve.

$4x + 3 = 13$

$-3 \quad -3$

$4x = 10$

$\div 4 \qquad \div 4$

$x = \frac{10}{4} = \frac{5}{2} = 2.5$

(a) $x =$ 2.5 ..... **[2]**

(b) Multiply out and simplify.

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

$10x + 15 + 2x - 8$

$12x + 7$

(b) 12x + 7 ..... **[3]**

3 **(a)** The ratio 45 minutes to 3 hours 45 minutes can be written in the form 1 : *n*.

Find the value of *n*.

3h 45 mins
↓×60
180 mins + 45 mins = 225 mins

45 : 225
÷45 ÷45
1 : 5

n = 5

$45\overline{)225}$ = 5

(a) *n* = 5 **[2]**

(b) Reece and Sarah share some money in the ratio 9 : 16.

Reece says that Sarah gets more than 60% of this money.

Show that Reece is correct.

R : S
9 : 16

Total = 9 + 16
= 25 parts

$\frac{16}{25} \overset{\times 4}{=} \frac{64}{100} = 64\%$

64% > 60% **[3]**

4 Dora has the following number cards.

She takes a card at random, replaces the card and then takes a second card.
She adds the numbers on the two cards she has taken and records the total.

(a) Complete the following table to show all of her possible totals.

		First card				
	Total	2	2	3	5	6
Second card	2	4	4	5	7	8
	2	4	4	5	7	8
	3	5	5	6	8	9
	5	7	7	8	10	11
	6	8	8	9	11	12

[1]

(b) Find the probability that her total is

(i) an even number,

(b)(i) $\frac{13}{25}$ ..... **[2]**

(ii) a multiple of 3 or 4.

(ii) $\frac{14}{25}$ ..... **[2]**

5 Charlie and Jasmine share cartons of apple juice.

Charlie drinks $\frac{1}{3}$ of a carton every day.

Jasmine drinks $\frac{2}{5}$ of a carton every day.

Any apple juice left in a carton at the end of the day is used the following day.

The cost of a carton is 70p.
Charlie and Jasmine buy just enough cartons to last them for 10 days.

How much do they spend in total for these cartons?
Give your answer in £.
Show your working.

Charlie = $\frac{1}{3} \times 10 = \frac{10}{3} = 3\frac{1}{3}$ cartons for 10 days

Jasmine = $\frac{2}{5} \times 10 = \frac{20}{5} = 4$ cartons for 10 days

Total cartons = $3\frac{1}{3} + 4 = 7\frac{1}{3}$

≈ 8 cartons

Total cost = $8 \times 70p$

$= 560p$

$\div 100$

$= £5.60$

£ 5.60 **[6]**

6 A clock chimes every 20 minutes.
A light flashes every 8 minutes.
The clock chimes and the light flashes together at 08:00.

How many times between 08:01 and 12:30 will the clock chime and the light flash together?
Show your working.

Clock 20 40 60 80 100 120

Light 8 16 24 32 40 48

LCM = 40

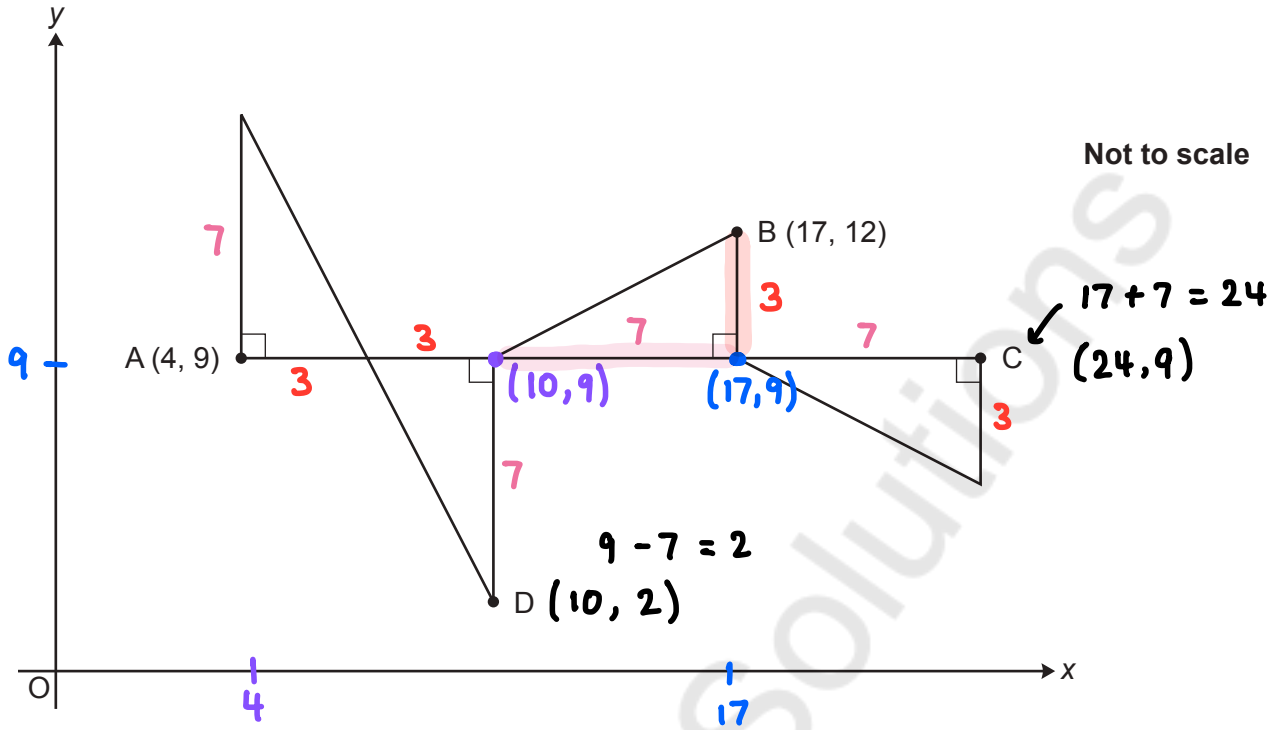
8:00

8:40
9:20
10:00
10:40
11:20
12:00
} 6 times

12:40

6 ..... [5]

7 A pattern is made from four congruent right-angled triangles.



The line AC is parallel to the *x*-axis.
The point A has coordinates (4, 9) and the point B has coordinates (17, 12).

Work out the coordinates of point C and point D.

C (24 , 9)

D (10 , 2) **[5]**

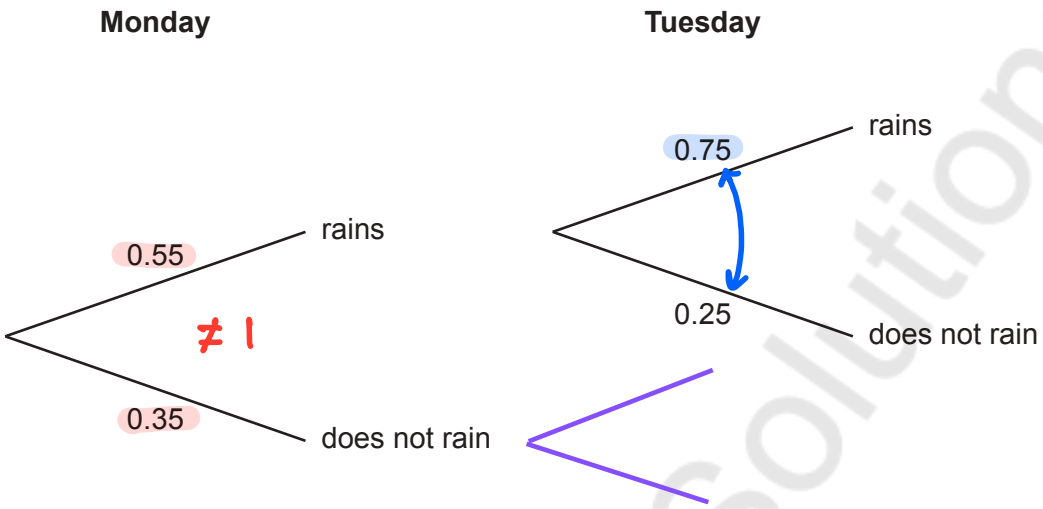
8 A weather forecast says

- the probability that it will rain on Monday is 0.55

and

- the probability that it will rain on Tuesday is 0.25.

Ella draws a tree diagram to show this information.



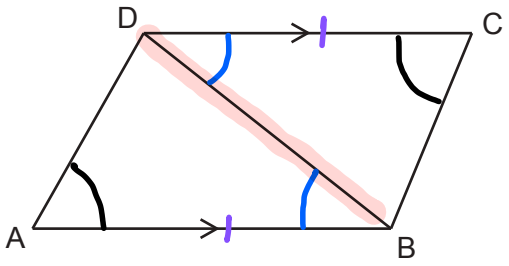
Write down three errors that Ella has made with her tree diagram.

1 For Tuesday, the probability that it rains should be 0.25 not 0.75

2 For Monday, probabilities should sum to 1, not 0.9.

3 A pair of branches is missing for Tuesday if it does not rain on Monday. **[3]**

9 In the diagram, AB and DC are parallel lines of equal length.



Not to scale

Prove that angle DAB = angle BCD.

Angle CDB = angle DBA - alternate angles are equal

BD is common to triangles DAB and DCB

DC = AB given

Triangles DAB and DCB congruent by SAS

∴ angle DAB = angle BCD.

..... [4]

10 Each day, Eve records how long it takes her to complete a puzzle.

On Friday, she took 50% less time than on Thursday.
On Saturday, she took 20% less time than on Friday.
On Saturday, she takes 36 minutes to complete the puzzle.

How many minutes did she take to complete the puzzle on Thursday?
Show your working.

Friday = 100 − 50 = 50% $\xrightarrow{\div 100}$ 0.5

= 0.5 × Thursday

Saturday = 100 − 20 = 80% $\xrightarrow{\div 100}$ 0.8

= 0.8 × (0.5 × Thursday)

= 0.4 × Thursday

36 = 0.4 × Thursday

÷0.4 ÷0.4

$36 \div \frac{4}{10}$

$36 \times \frac{10}{4} = \frac{360}{4} = 90$ mins

90 ..... minutes **[5]**

11 **(a)** Work out.

$16^{-\frac{1}{2}}$

$\frac{1}{16^{\frac{1}{2}}} = \frac{1}{\sqrt{16}} = \frac{1}{4}$

$\frac{1}{4}$

(a) ..... **[2]**

(b) Simplify.

$\sqrt{6} \times \sqrt{3}$

$\sqrt{3}\sqrt{2} \times \sqrt{3} = 3\sqrt{2}$

(b) $3\sqrt{2}$ ..... **[2]**

12 The price, £P, of a car is £20 000 in 2019.
The price is expected to decrease by 5% each year after 2019.

(a) Jasmine says

This means the price in 2021 is expected to be £18 000.

She is incorrect.
Explain her error and work out the correct answer.

5% of 20000 = 1000

20,000 - 1000 = £19,000 [2020]

5% of 19000 = 950

19000 - 950 = £18050 [2021]

Her error is ..she has decreased 20,000 by 10%..

.....

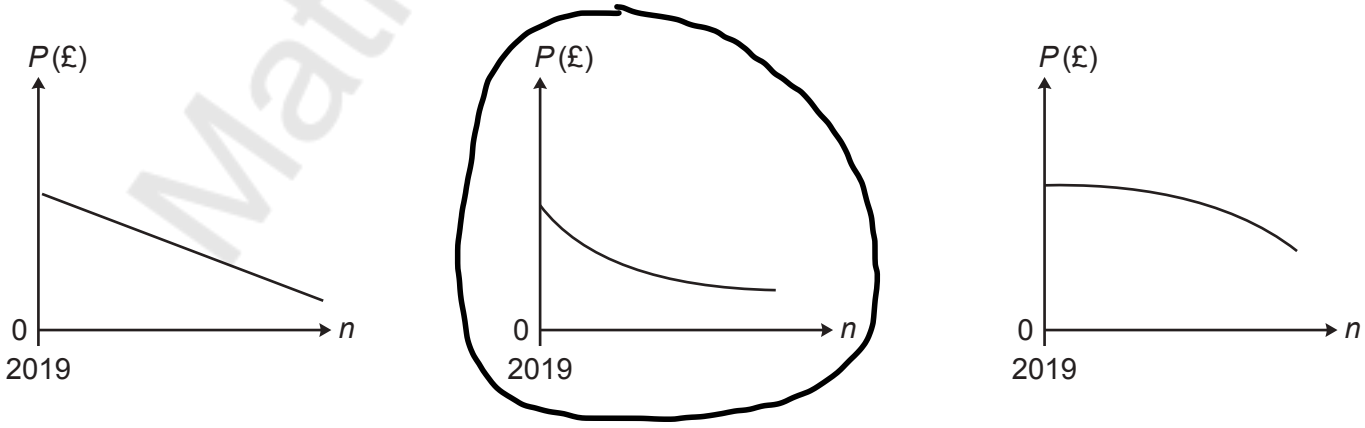
The correct answer is £ ..18050.. **[4]**

(b) **(i)** Write a formula for P in terms of n, where n is the number of years after 2019.

100 - 5 = 95% $\xrightarrow{\div 100}$ 0.95

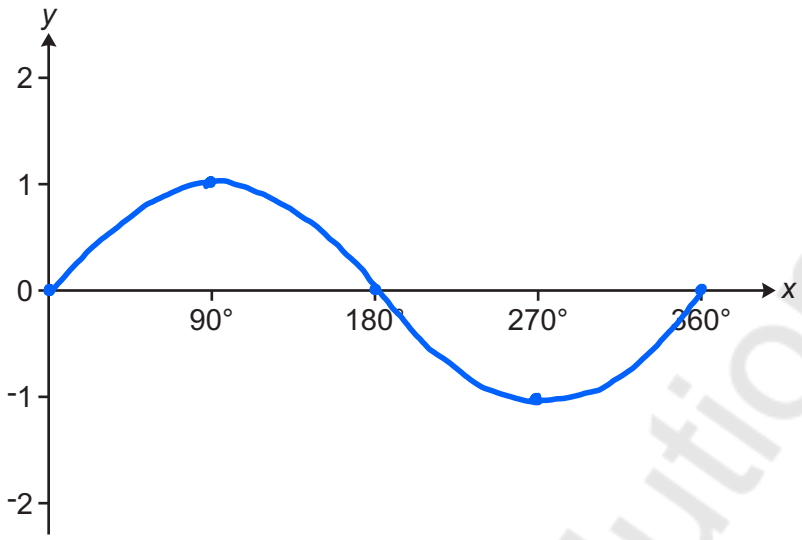
(b)(i) $P =$ ..20000 x 0.95^n.. **[2]**

(ii) Circle the graph that best represents the price, £P, of the car n years after 2019.



[1]

13 **(a)** Sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) The graph of $y = \cos(x - 30)$ for $0° \leqslant x \leqslant 360°$ crosses the x-axis in two places.

Write down the values of x where this occurs.

$0 = \cos(x - 30)$

$\cos^{-1}(0) = x - 30$

$90° = x - 30$

$+30 \qquad +30$

$120° = x$

$x = 120 + 180$

$= 300°$

$x =$ ..... 120° ..... and ..... 300° ..... **[2]**

14 Simplify.

(a) $4a^{\frac{1}{2}} \times 3a^2$

$4 \times 3 = 12$

$a^{\frac{1}{2}} \times a^2 = a^{\frac{1}{2}+2}$

$= a^{5/2}$

(a) $12a^{\frac{5}{2}}$ **[2]**

(b) $\left(\frac{2a^2}{1a^{-3}}\right)^3$

$2 \div 1 = 2$

$a^2 \div a^{-3} = a^{2--3}$

$= a^5$

$(2a^5)^3 = 2^3 a^{5\times3}$

$= 8a^{15}$

(b) $8a^{15}$ **[3]**

15 Solve.

$\frac{x}{x+6} = 5$

$x \times x+6 \quad x \times x+6$

$x = 5(x+6)$

$x = 5x + 30$

$-5x \quad -5x$

$-4x = 30$

$\div -4 \quad \div -4$

$x = -7.5$

$x =$ -7.5 **[3]**

16 (a) The masses, m kg, of some parcels are shown below.

4 15 14 11 12 3 1 18 13 2 16 10

Jack constructs this grouped frequency table to record the masses.

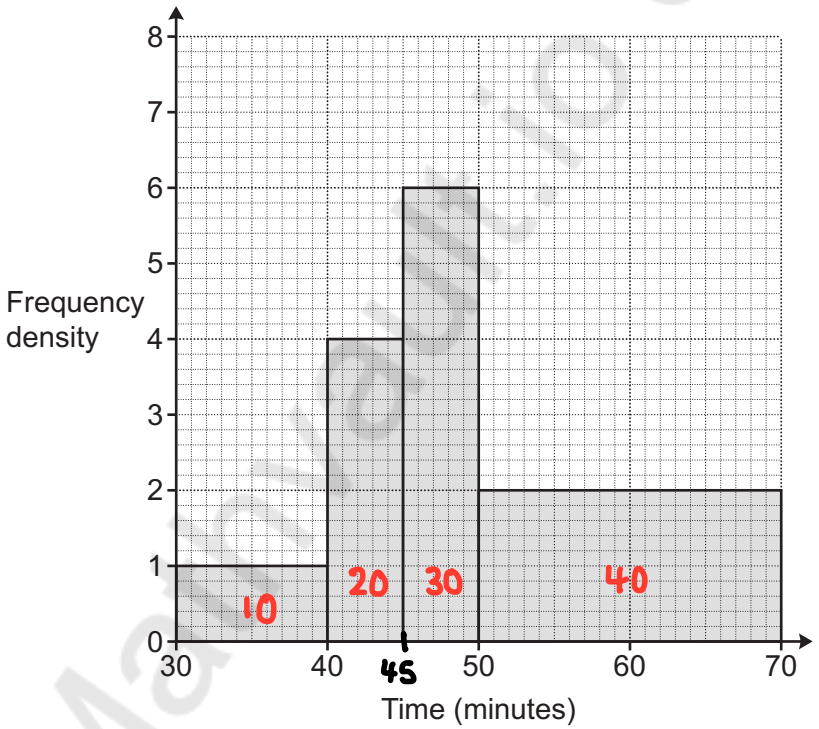
Mass (m kg)	Tally	Frequency
$0 \leqslant m \leqslant 5$		
$5 \leqslant m \leqslant 10$		
$10 \leqslant m \leqslant 15$		
$15 \leqslant m \leqslant 20$		

Explain why Jack's table is unsuitable to record the masses.

The groups overlap.

[1]

(b) The histogram summarises the times taken, in minutes, by some students to complete a race.



Freq = FD x CW

(i) Show that 70 students took between 45 and 70 minutes to complete the race. **[2]**

5 x 6 = 30 students 45 - 50 mins

20 x 2 = 40 students 50 - 70 mins

Total = 30 + 40

= 70 students.

(ii) Calculate an estimate of the mean time taken to complete the race.
Show your working.

Time (mins)	Frequency	Midpoints	Midpoint x freq
30 - 40	10	35	35 x 10 = 350
40 - 45	20	42.5	42.5 x 20 = 850
45 - 50	30	47.5	47.5 x 30 = 1425
50 - 70	40	60	60 x 40 = 2400
	100		5025

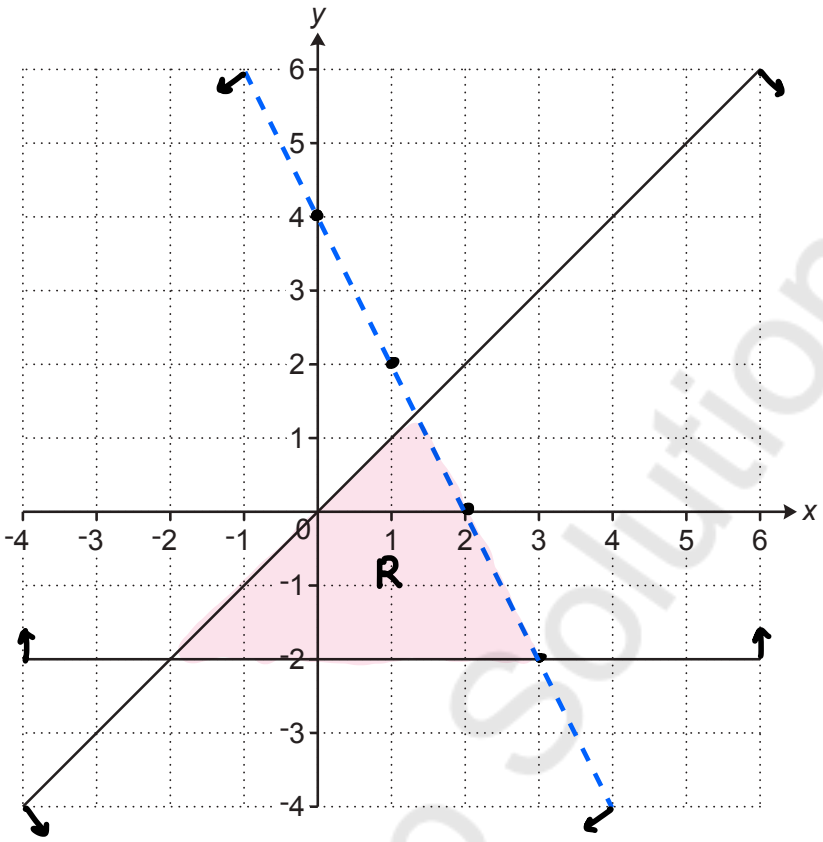
$^{2}4^{1}7.5$
x 30
1425.0

$$\text{Mean} = \frac{5025}{100}$$

$$= 50.25$$

(b)(ii) 50.25 min **[5]**

17 The graphs of $y = x$ and $y = -2$ are drawn on the grid.



The region R satisfies the following inequalities.

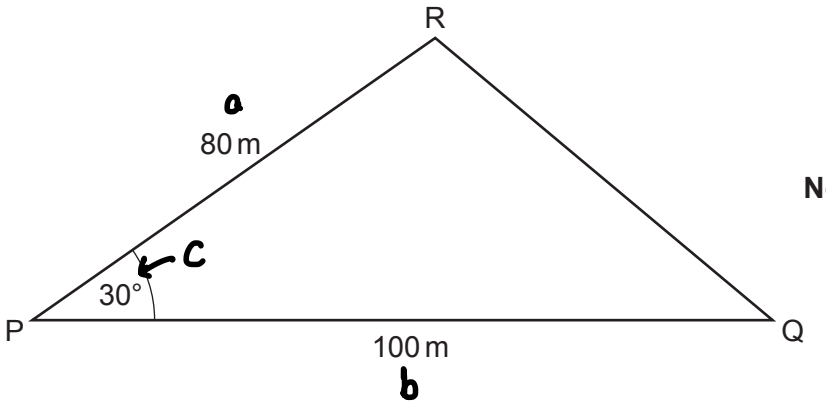
$y \geqslant -2$ ✓ $y \leqslant x$ ✓ $y < 4 - 2x$

By drawing one more line, find and label the region R. **[5]**

$y = 4 - 2x$

x	0	1	2	3
y	4	2	0	-2

18 The diagram shows a triangular field PQR which is used to grow organic carrots.



Not to scale

PQ = 100 m, PR = 80 m and angle RPQ = 30°.

In recent years, an average of 2.5 kg of carrots has been harvested from each square metre of the field.

(a) Use this information to work out the total mass of carrots that might have been harvested from the field in 2019.

Area $= \frac{1}{2}ab\sin C$

$= \frac{1}{2} \times 80 \times 100 \times \sin 30$

$= 40 \times 100 \times \sin 30$

$= 4000 \times \sin 30$

$= 4000 \times \frac{1}{2}$

$= 2000\ m^2$

$\sin 30° = \frac{1}{2}$

Mass of carrots $= 2000 \times 2.5$

$= 5000\ kg$

(a) 5000 kg **[4]**

(b) Why might the answer to part **(a)** be unreliable?

Conditions for growth of carrots may be different due to weather or diseases. **[1]**

19 **(a)** Write $x^2 - 10x + 22$ in the form $(x - a)^2 - b$.

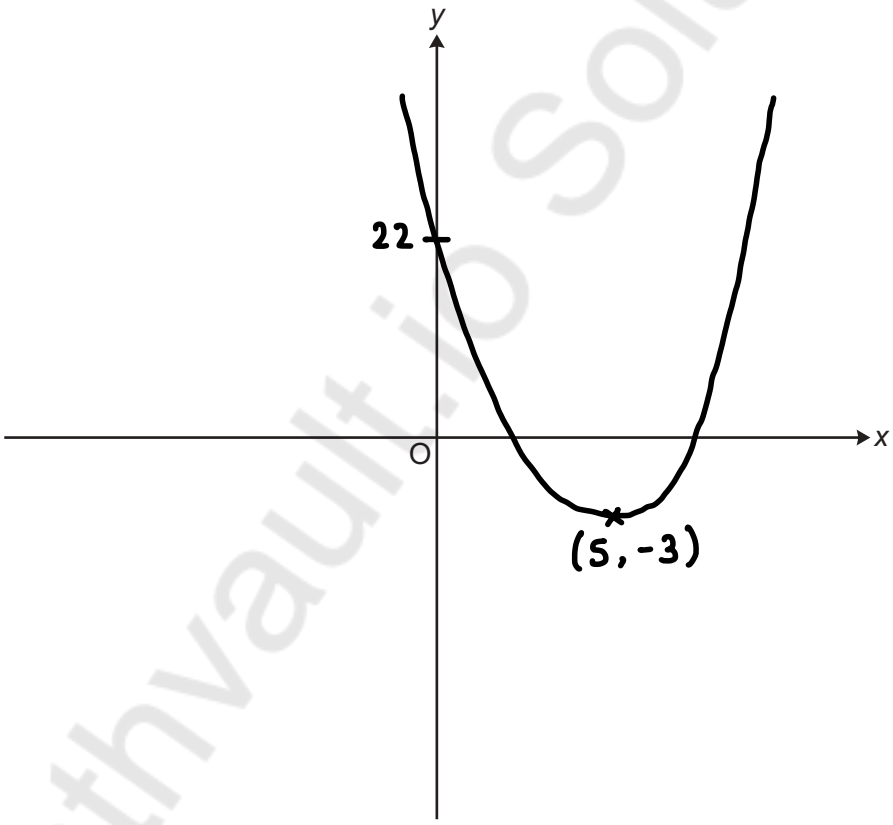
$(x - 5)^2 - (-5)^2 + 22$

$(x-5)^2 - 25 + 22$

$(x-5)^2 - 3$

(a) $(x-5)^2 - 3$ **[3]**

(b) Sketch the graph of $y = x^2 - 10x + 22$.
Show clearly the coordinates of any turning points and the value of the y-intercept.



[4]

$y = (x-5)^2 - 3$

Turning point = $(5, -3)$

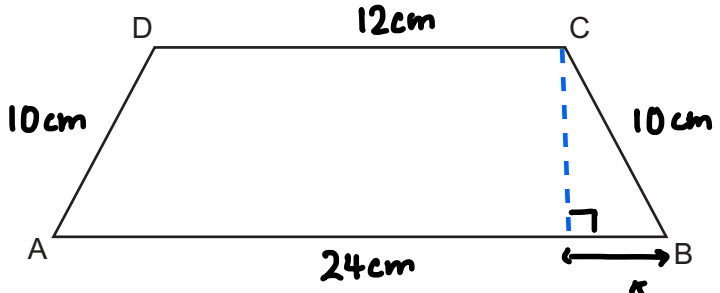
$y = x^2 - 10x + 22$

$y = 0^2 - 10(0) + 22$

$y = 22$

$(0, 22)$ - y-intercept

20 ABCD is a trapezium.



Not to scale

24 − 12 = 12 ÷ 2 = 6cm

The perimeter of the trapezium is 56 cm.
The ratio AD : AB : DC : BC = 5 : 12 : 6 : 5.

Calculate the area of the trapezium.
Show your working.

AD : AB : DC : BC

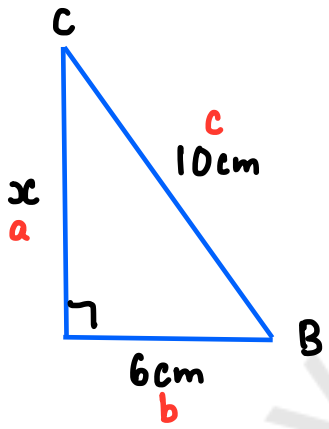
5 : 12 : 6 : 5

×2 ×2 ×2 ×2

10cm 24cm 12cm 10cm

Total parts = 28

56cm ÷ 28 = 2



$a^2 + b^2 = c^2$

$x^2 + 6^2 = 10^2$

$-6^2 \quad -6^2$

$x^2 = 10^2 - 6^2$

$x^2 = 100 - 36$

$x^2 = 64$

$\sqrt{\quad} \quad \sqrt{\quad}$

$x = 8$

Area trapezium

$= \frac{1}{2}(a+b) \times h$

$= \frac{1}{2}(12+24) \times 8$

$= \frac{1}{2}(36) \times 8$

$= 18 \times 8$

$= 144\ cm^2$

144 cm^2 **[7]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).