Name: _____

GCSE (1 – 9)

Ratio Fraction Problems

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- 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

1 In a bag there are blue sweets and red sweets. The ratio of blue sweets to red sweets is 5:3

What fraction of the sweets are blue?

5 Parts Blue

8 Parts in Total (5+3)

$\frac{5}{8}$

(Total for question 1 is 2 marks)

2 In a bag there are blue sweets and red sweets. The ratio of blue sweets to red sweets is 2:7

What fraction of the sweets are red?

7 parts red

9 parts in total

$\frac{7}{9}$

(Total for question 2 is 2 marks)

3 In a bag there are blue sweets and red sweets. The ratio of blue sweets to red sweets is 4:9

What fraction of the sweets are blue?

4 parts blue

13 parts in total

$\frac{4}{13}$

(Total for question 3 is 2 marks)

4 In a bag there are blue sweets, red sweets and green sweets.
The ratio of blue sweets to red sweets to green sweets is 5:3:2
B R G

What fraction of the sweets are green?

2 parts green
10 parts in total

$\frac{2}{10}$ or $\frac{1}{5}$

$\frac{1}{5}$

(Total for question 4 is 2 marks)

5 In a bag there are blue sweets, red sweets and green sweets.
The ratio of blue sweets to red sweets to green sweets is 2:4:5
B R G

What fraction of the sweets are red?

4 parts red
11 parts in total

$\frac{4}{11}$

(Total for question 5 is 2 marks)

6 In a bag there are blue sweets, red sweets and green sweets.
The ratio of blue sweets to red sweets to green sweets is 6:9:4
B R G

What fraction of the sweets are blue?

6 parts blue
19 parts in total

$\frac{6}{19}$

(Total for question 6 is 2 marks)

7 In a bag there are only red sweets and yellow sweets. $\frac{2}{3}$ of the sweets are red.

Write down the ratio of red sweets to yellow sweets?

$\frac{2}{3}$ Red $\frac{1}{3}$ Yellow

2 : 1

2 : 1

(Total for question 7 is 2 marks)

8 In a bag there are only red sweets and yellow sweets. $\frac{3}{5}$ of the sweets are red.

Write down the ratio of red sweets to yellow sweets?

$\frac{3}{5}$ Red $\frac{2}{5}$ Yellow

3 : 2

3 : 2

(Total for question 8 is 2 marks)

9 In a bag there are only blue sweets and green sweets. $\frac{5}{6}$ of the sweets are green.

Write down the ratio of blue sweets to green sweets?

$\frac{5}{6}$ green $\frac{1}{6}$ Blue

Blue to Green

1 : 5

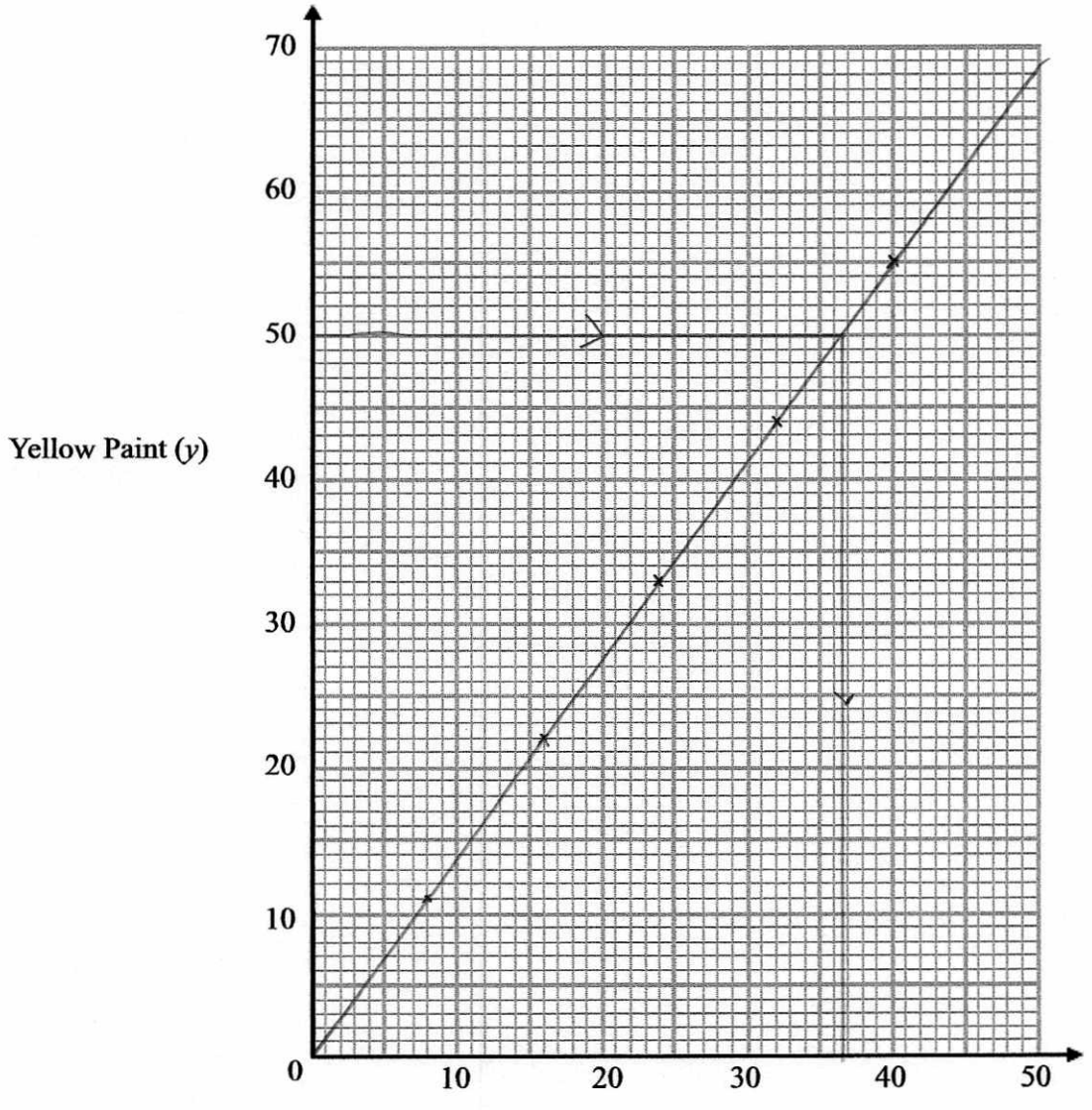
1 : 5

(Total for question 9 is 2 marks)

10 An artist is making orange paint by mixing red paint (x ml) and yellow paint (y ml) in the ratio 8:11

(a) Use this information to draw a graph showing the relationship between the amount of red paint and the amount of yellow paint used.

x	8	16	24	32	40
y	11	22	33	44	55



(2)

(b) The artist decides to use 50ml of yellow paint. Use your graph to work out how much red paint he should use.

36.5 ml

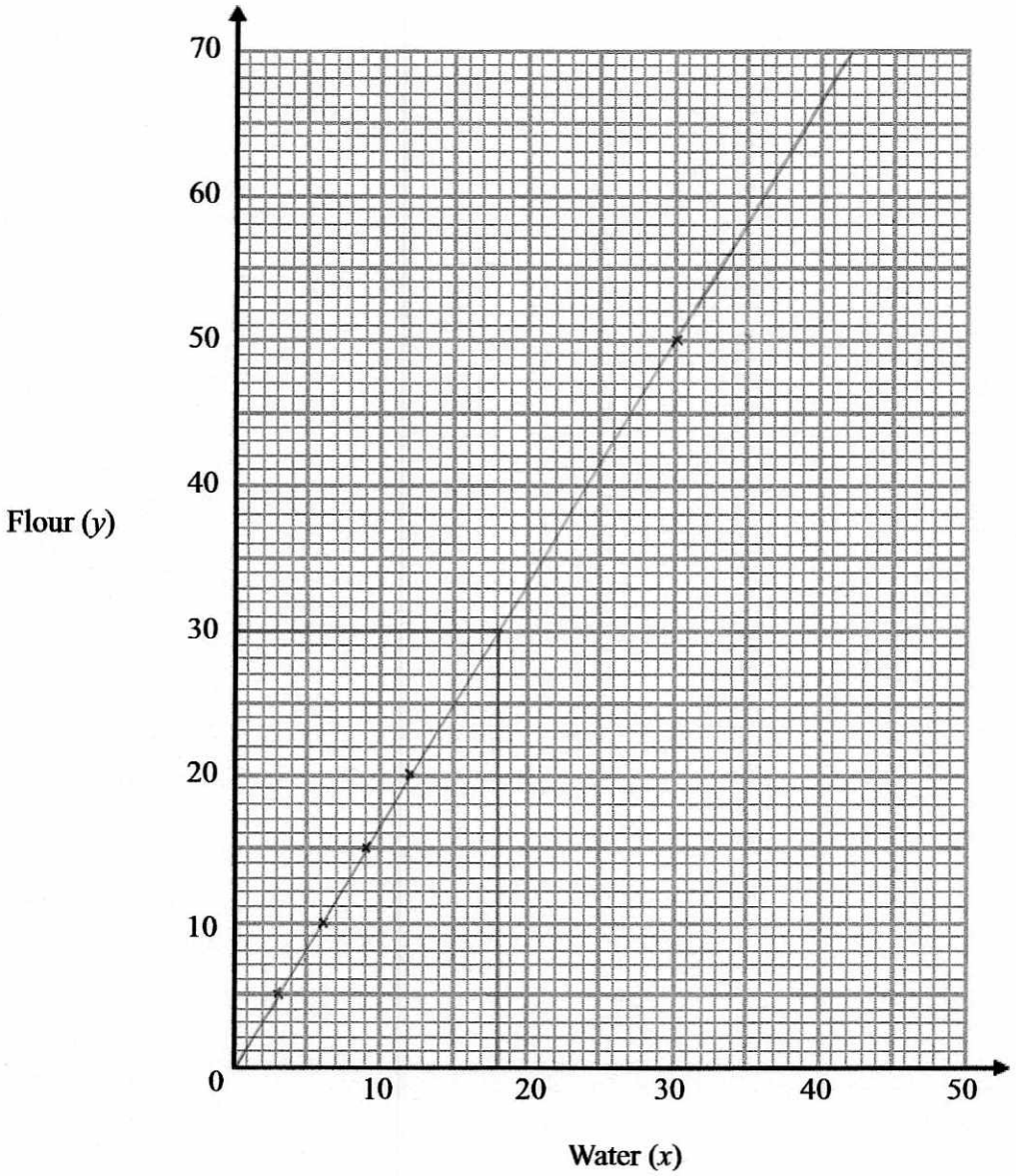
(36 – 37) (2)

(Total for question 10 is 4 marks)

11 An baker makes bread using the ratio of flour (y cups) to water (x cups) of 5:3.

(a) Use this information to draw a graph showing the relationship between the amount of flour and the amount water used to make bread.

x	3	6	9	12	30
y	5	10	15	20	50



(2)

(b) The baker is going to use 30 cups of flour. Use your graph to work out how much water the baker should use.

18 cups

(2)

(Total for question 11 is 4 marks)

12 In a cinema the ratio of adults to children is 3:1 (4 PARTS)
The ratio of boys to girls is 3:2 (5 PARTS)

What fraction of all the people in the cinema are girls?

$\frac{3}{4}$ Adults $\frac{1}{4}$ Children

$\frac{3}{5}$ Boys $\frac{2}{5}$ Girls

$\frac{2}{5}$ of $\frac{1}{4}$

$\frac{2}{5} \times \frac{1}{4} = \frac{2}{20} = \frac{1}{10}$

$\frac{1}{10}$

(Total for question 12 is 3 marks)

13 On a school trip the ratio of staff to students is 1:10 (11 PARTS)
All of the students are from either year 7 or year 8. The ratio of year 7 students to year 8 students is 3:2 (5 PARTS)

What fraction of all the people on the trip are year 7 students?

$\frac{1}{11}$ STAFF $\frac{10}{11}$ STUDENTS

$\frac{3}{5}$ YEAR 7 $\frac{2}{5}$ YEAR 8

$\frac{3}{5}$ of $\frac{10}{11}$

$\frac{3}{5} \times \frac{10}{11} = \frac{30}{55} = \frac{6}{11}$

$\frac{6}{11}$

(Total for question 13 is 3 marks)

14 In a theatre the ratio of adults to children is 7:3 10 PARTS
The ratio of boys to girls is 3:2 5 PARTS

What percentage of all the people in the cinema are girls?

$\frac{7}{10}$ ADULTS $\frac{3}{10}$ CHILDREN

$\frac{3}{5}$ BOYS $\frac{2}{5}$ GIRLS

$\frac{2}{5}$ of $\frac{3}{10}$ = $\frac{6}{50}$ = $\frac{12}{100}$ = 12%

$\left[\frac{2}{5} \times \frac{3}{10}\right]$

12%

(Total for question 14 is 3 marks)

---

15 In a company the ratio of men to women is 2:3 (5 PARTS)
30% of the women are under the age of 30.
$\frac{3}{10}$
What fraction of all the people in the company are women under the age of 30?

$\frac{2}{5}$ MEN $\frac{3}{5}$ WOMEN

$\frac{3}{10}$ or $\frac{3}{5}$

$\frac{3}{10} \times \frac{3}{5} = \frac{9}{50}$

$\frac{9}{50}$

(Total for question 15 is 3 marks)

Name: _____

GCSE (1 – 9)

Venn Diagrams

Instructions

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Advice

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1 Given that $P(A) = 0.9$, find $P(A')$

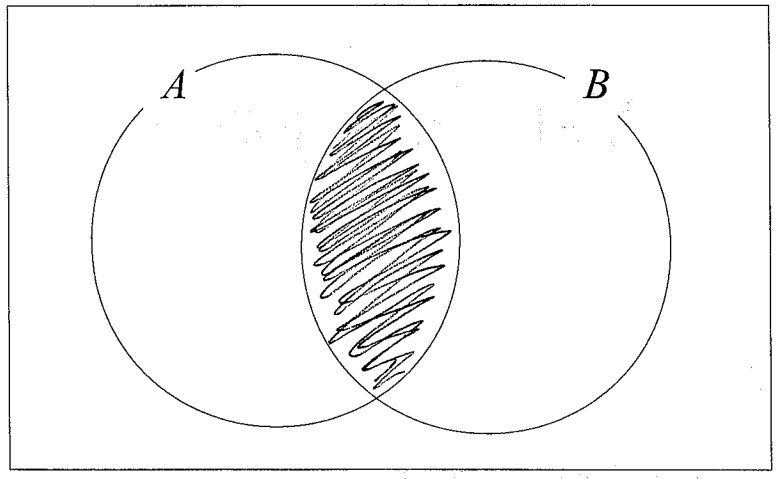
$1 - 0.9$

0.1

(Total for question 1 is 1 mark)

---

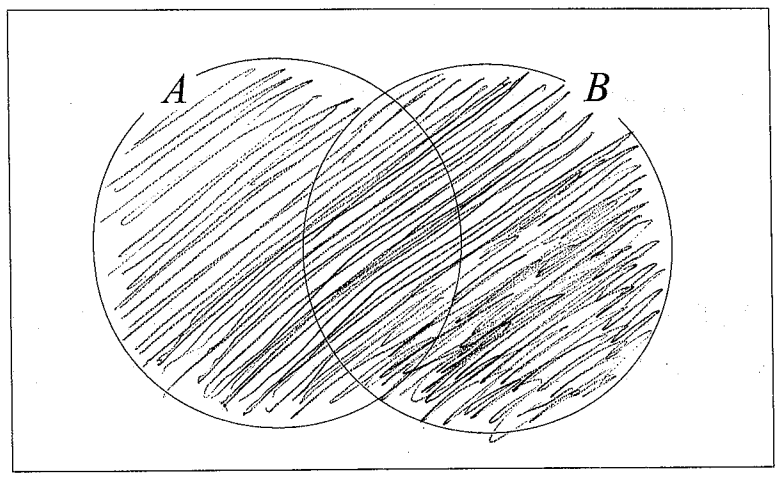
2 Shade the region that represents $(A \cap B)$



(Total for question 2 is 1 mark)

---

3 Shade the region that represents $(A \cup B)$



(Total for question 3 is 1 mark)

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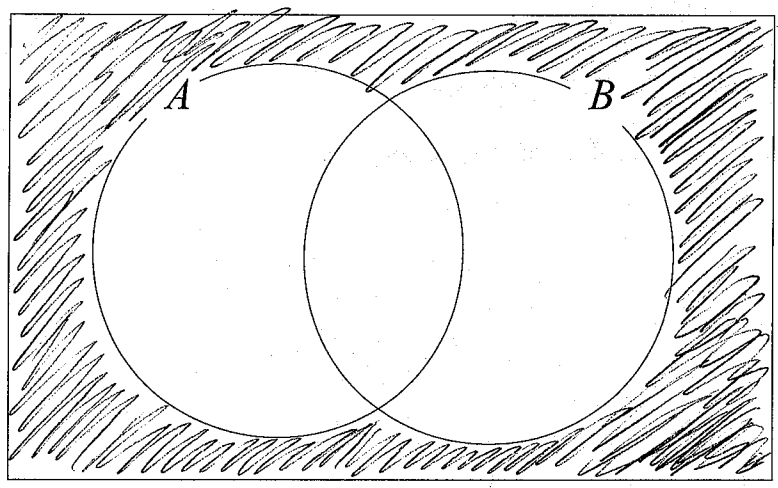
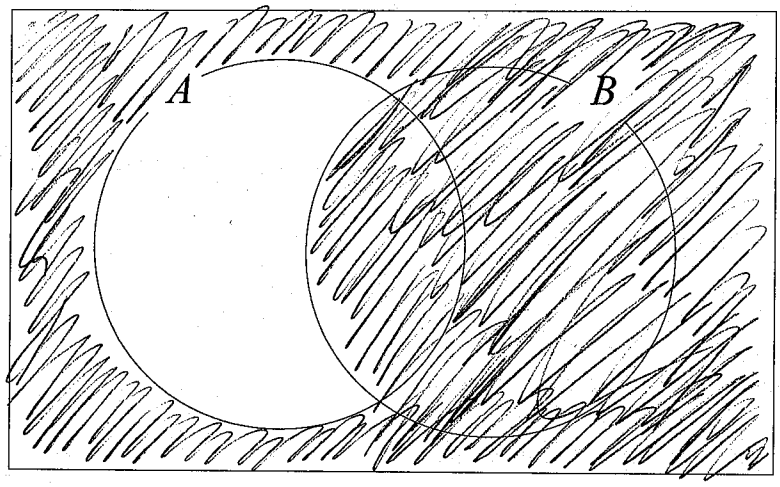
4 Shade the region that represents $(A' \cap B')$



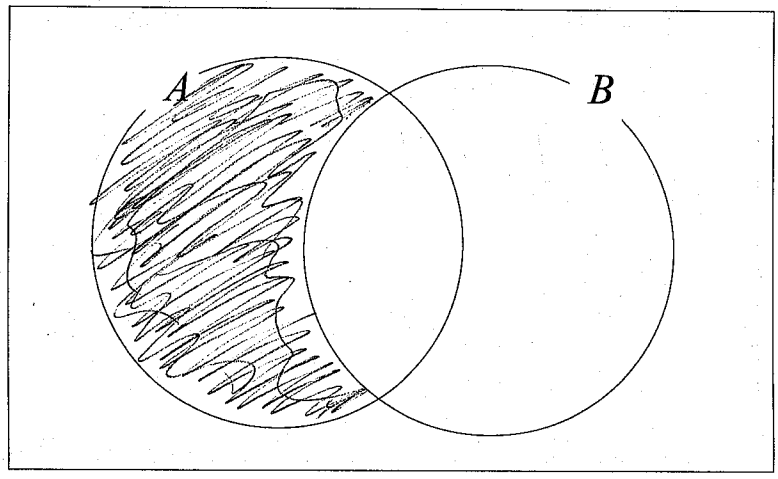
(Total for question 4 is 1 mark)

5 Shade the region that represents $(A' \cup B)$



(Total for question 5 is 1 mark)

6 Shade the region that represents $(A \cap B')$

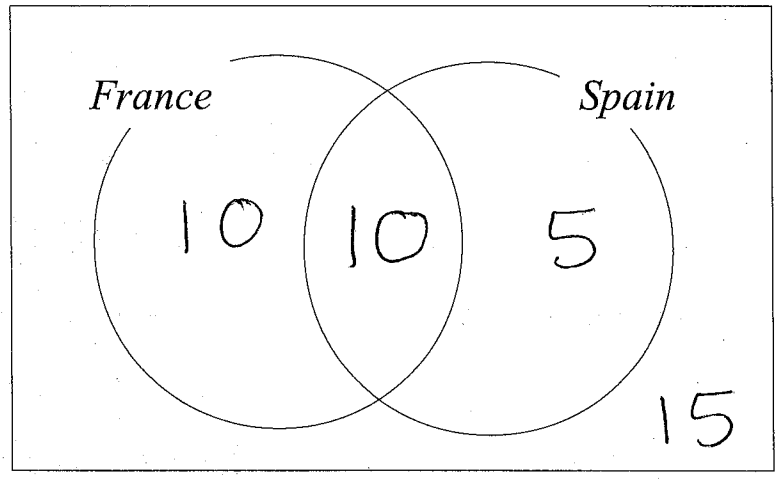


(Total for question 6 is 1 mark)

7 40 students were surveyed:

20 have visited France
15 have visited Spain
10 have visited both France and Spain

Use this information to complete the Venn Diagram



(Total for question 7 is 3 marks)

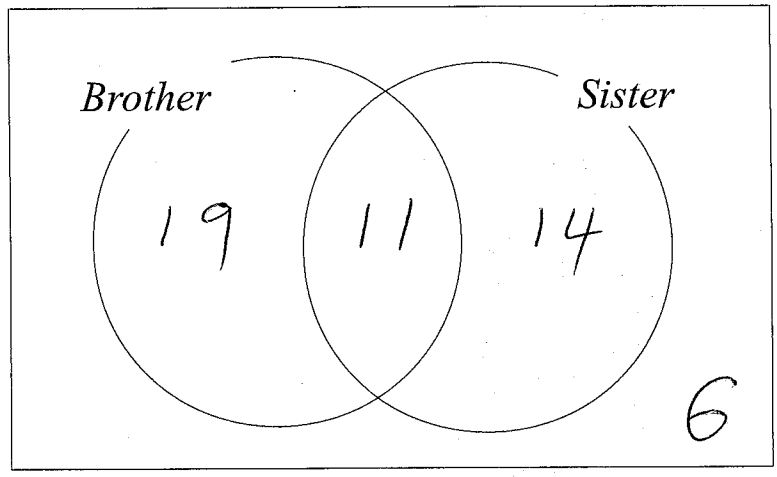
8 Out of 50 people surveyed:

30 have a brother
25 have a sister
6 have neither a brother or a sister

55

Use this information to complete the Venn Diagram

55 - 44 = 11



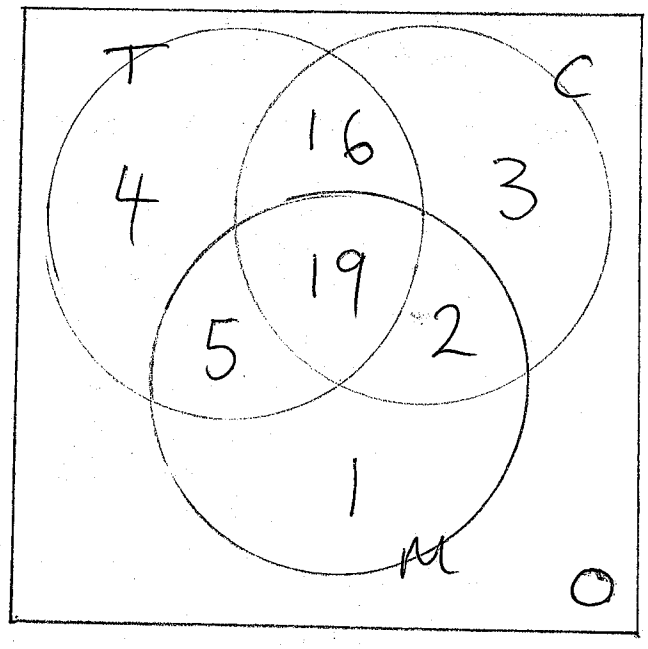
(Total for question 8 is 3 marks)

9 Sami asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks
19 people like all three drinks.
16 people like tea and coffee but do not like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

Sami selects at random one of the 50 people.

Work out the probability that this person likes tea.



$\frac{44}{50}$

.....

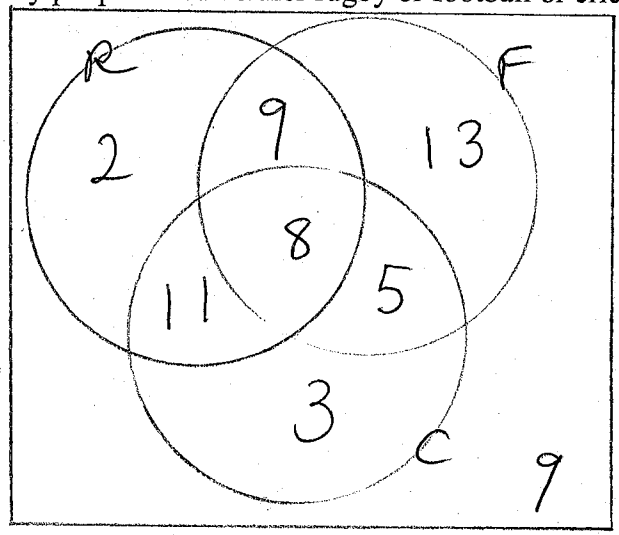
(Total for question 9 is 4 marks)

---

10 Sami asked 60 people which sports they liked from rugby, football and cricket.

8 people like all three sports.
17 people like rugby and football.
13 people like football and cricket.
19 people like rugby and cricket.
35 people like football.
27 people like cricket
30 people like rugby.

a) How many people liked neither rugby or football or cricket?



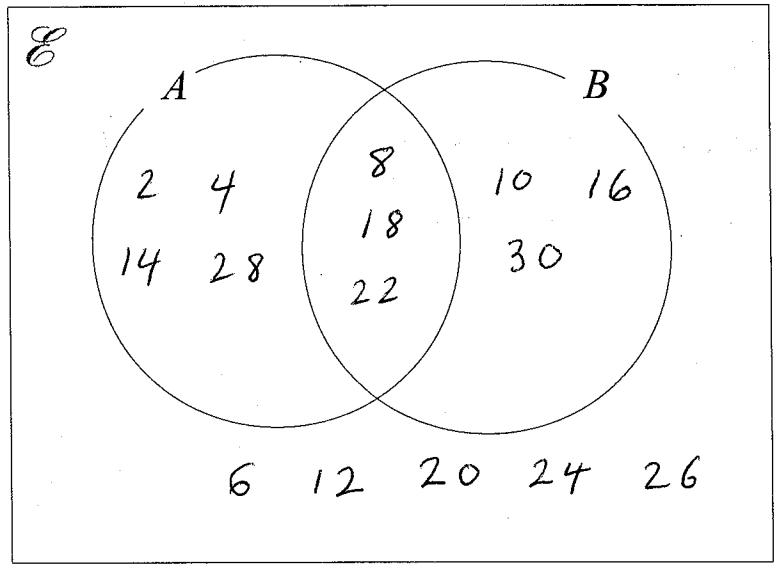
9

.....

(Total for question 10 is 4 marks)

11 $\mathscr{E}$ = {even numbers between 1 and 31}
A = {2, 4, 8, 14, 18, 22, 28}
B = {8, 10, 16, 18, 22, 30}

(a) Complete the Venn diagram to represent this information.



(4)

A number is chosen at random from the universal set, $\mathscr{E}$

(b) What is the probability that the number is in the set $A \cup B$?

$\frac{10}{15}$

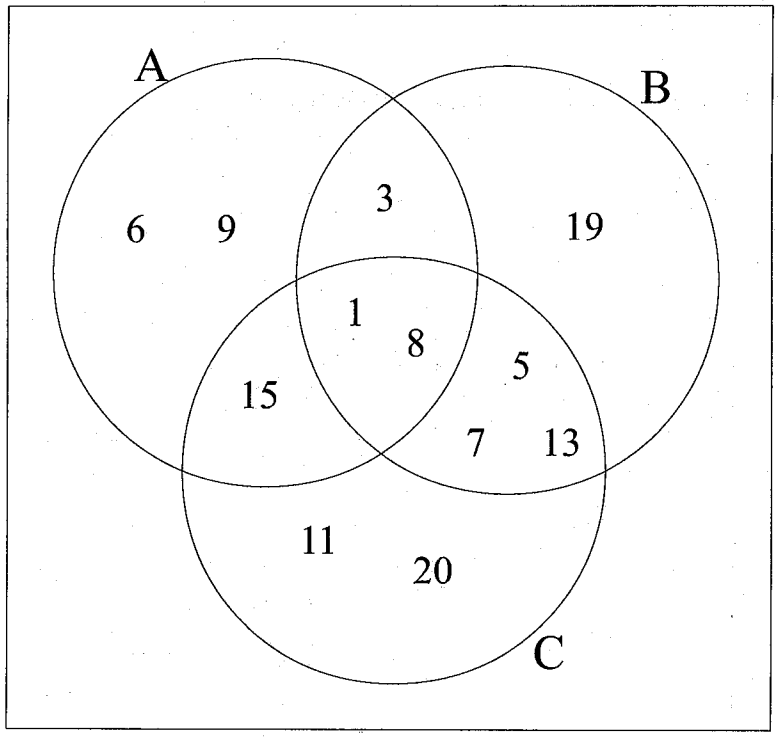
.....

(2)

(Total for question 11 is 6 marks)

$\left[\frac{2}{3}\right]$

12 Here is a Venn diagram.



(a) List the members of A ∩ B

1, 3 and 8

(1)

A number is chosen at random from $\mathscr{E}$.

(b) Find $P(B \cup C)$

$\frac{10}{12}$

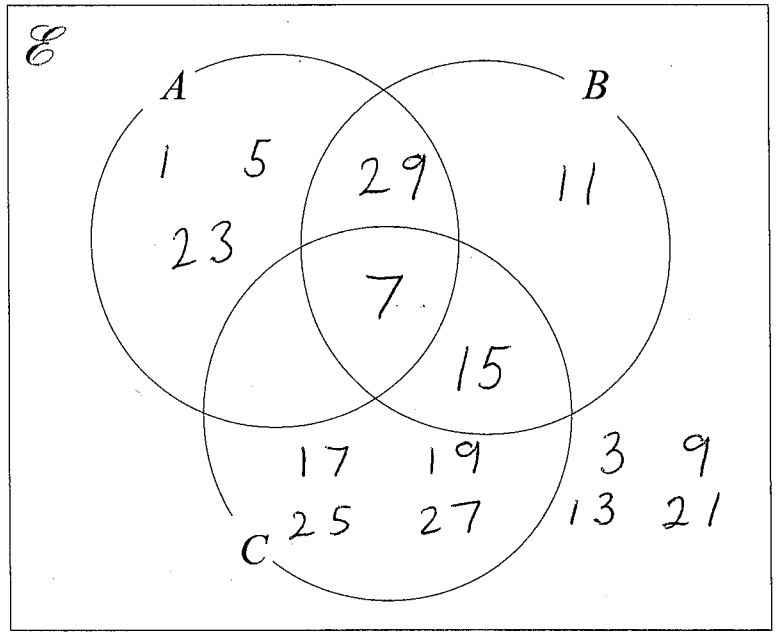
(2)

(Total for question 12 is 3 marks)

$\left[\frac{5}{6}\right]$

13 $\mathscr{E}$ = {odd numbers less than 30}
A = {1, 5, 7, 23, 29}
B = {7, 11, 15, 29}
C = {7, 15, 17, 19, 25, 27}

(a) Complete the Venn diagram to represent this information.



A number is chosen at random from $\mathscr{E}$.

(b) Find the probability that the number is a member of $(A \cap B)$.

$\frac{2}{15}$

(Total for question 26 is 3 marks)

Name: _____

GCSE (1 – 9)

Probability Trees

Instructions

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Advice

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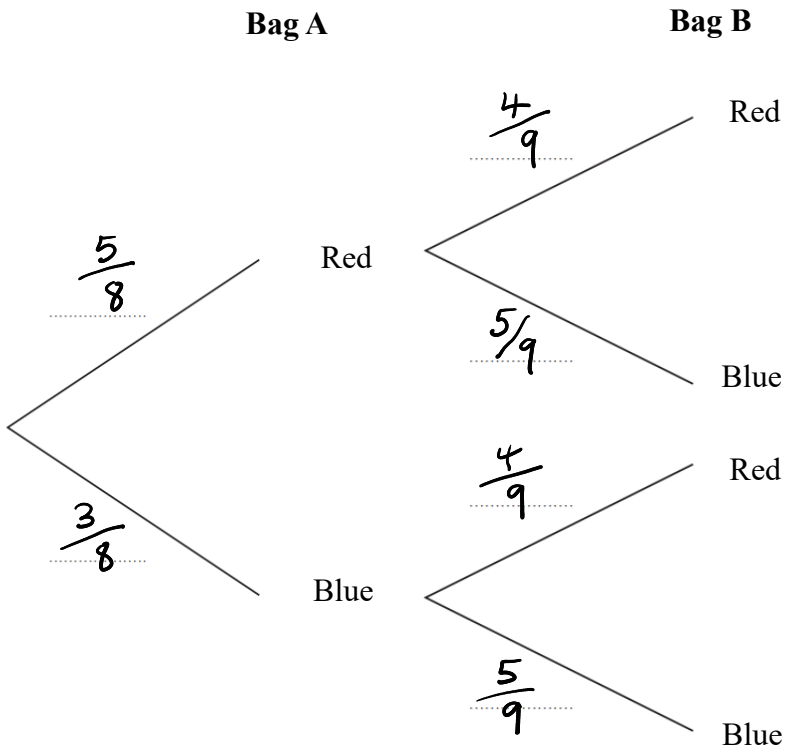
• Keep an eye on the time.
• Try to answer every question.
• Check your answers if you have time at the end

1 Tina has two bags of counters, Bag A and Bag B.

There are 5 red counters and 3 blue counters in bag A.
There are 4 red counters and 5 blue counters in bag B.

Tina takes at random a counter from each bag.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Tina takes two blue counters.

$\frac{3}{8} \times \frac{5}{9} = \frac{15}{72}$

$\frac{15}{72}$

(2)

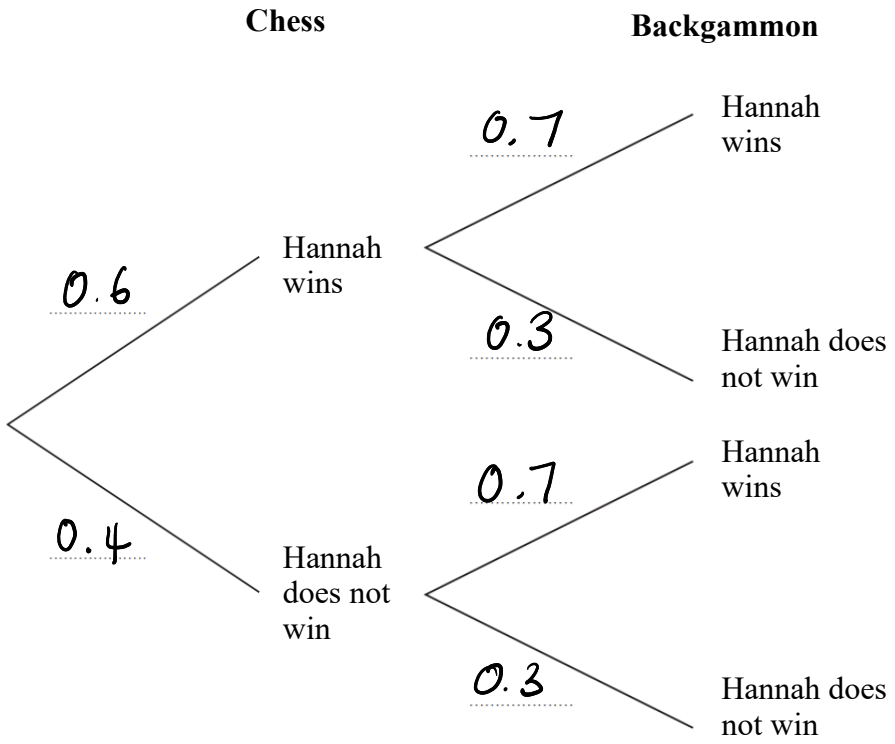
(Total for question 1 is 4 marks)

or $\frac{5}{24}$

2 Hannah is going to play one game of chess and one game of backgammon.

The probability she will win the game of chess is 0.6
The probability she will win the game of backgammon is 0.7.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Hannah will win both games.

$0.6 \times 0.7 = 0.42$

0.42

(2)

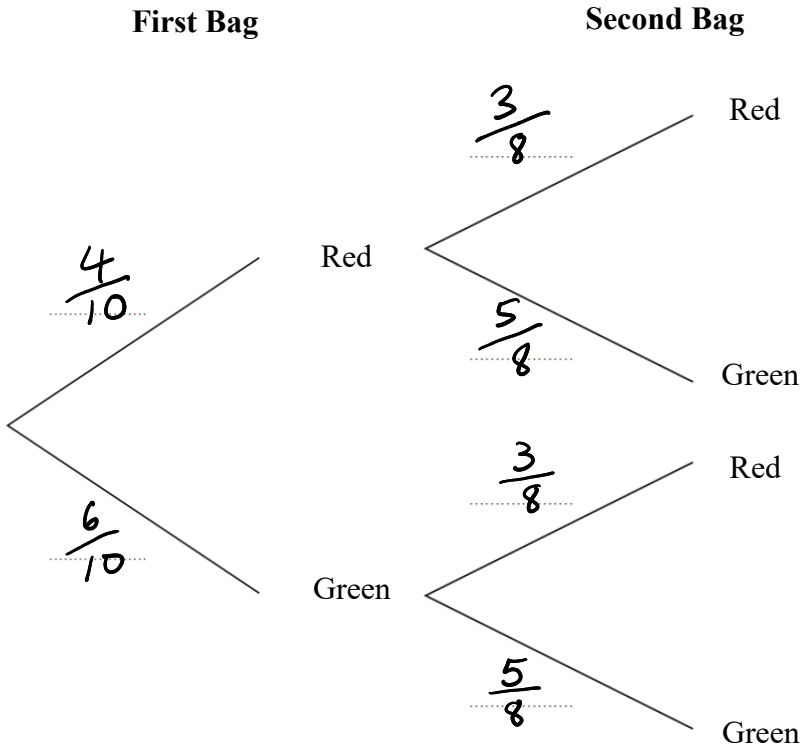
(Total for question 2 is 4 marks)

3 Rachel has two bags.

In the first bag there are 4 red balls and 6 green balls.
In the second bag there are 3 red balls and 5 green balls.

Rachel takes at random a ball from the first bag.
She then takes at random a ball from the second bag.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Rachel takes two green balls.

$\frac{6}{10} \times \frac{5}{8} = \frac{30}{80}$

$\frac{30}{80}$

(2)

(Total for question 3 is 4 marks)

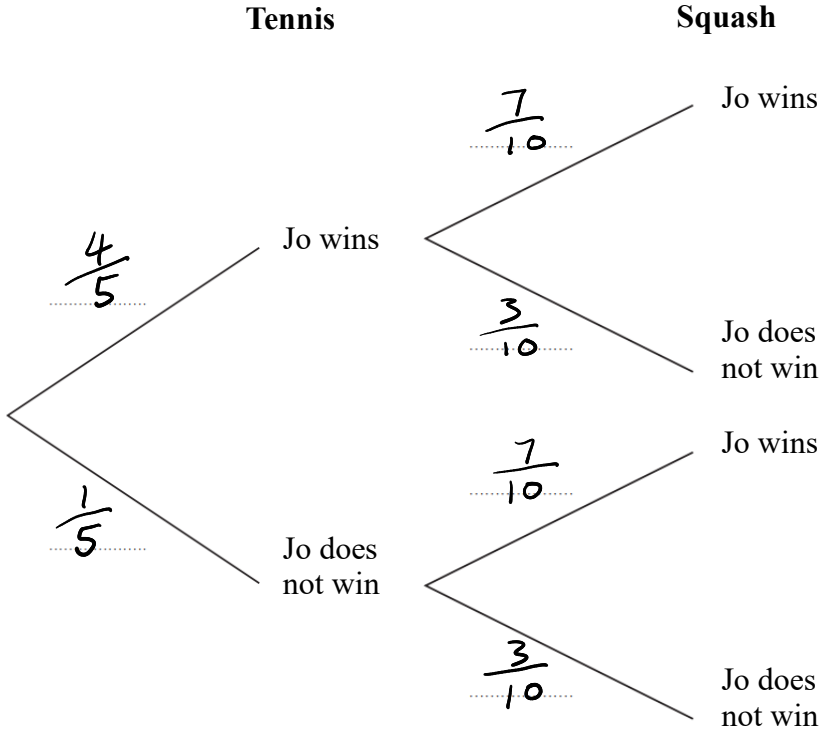
or $\frac{3}{8}$

4 Jo is going to play one tennis match and match of squash.

The probability she will win the tennis match is $\frac{4}{5}$

The probability she will win the squash match is $\frac{7}{10}$

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Jo will win both matches.

$\frac{4}{5} \times \frac{7}{10} = \frac{28}{50}$

$\frac{28}{50}$

(2)

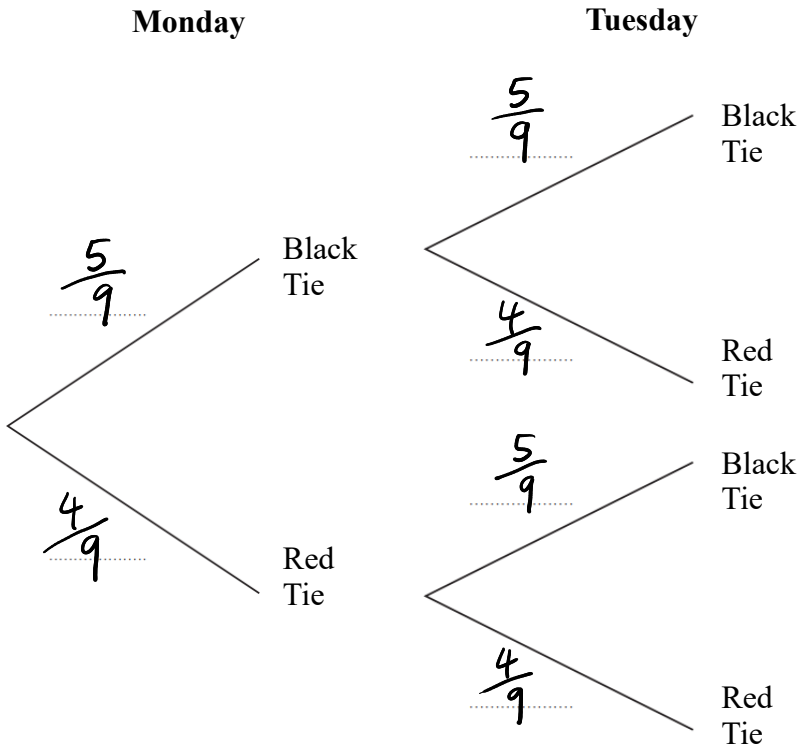
(Total for question 4 is 4 marks)

$\left(\frac{14}{25}\right)$

5 Each day Paul wears either a black tie or a red tie to work.

On any day the probability he wears a black tie is $\frac{5}{9}$

(a) Complete the probability tree diagram for Monday and Tuesday.



(2)

(b) Work out the probability Paul wears different coloured ties on Monday and Tuesday .

Black, Red or Red, Black

$\frac{5}{9} \times \frac{4}{9} + \frac{4}{9} \times \frac{5}{9}$

$\frac{20}{81} + \frac{20}{81}$

$\frac{40}{81}$

(2)

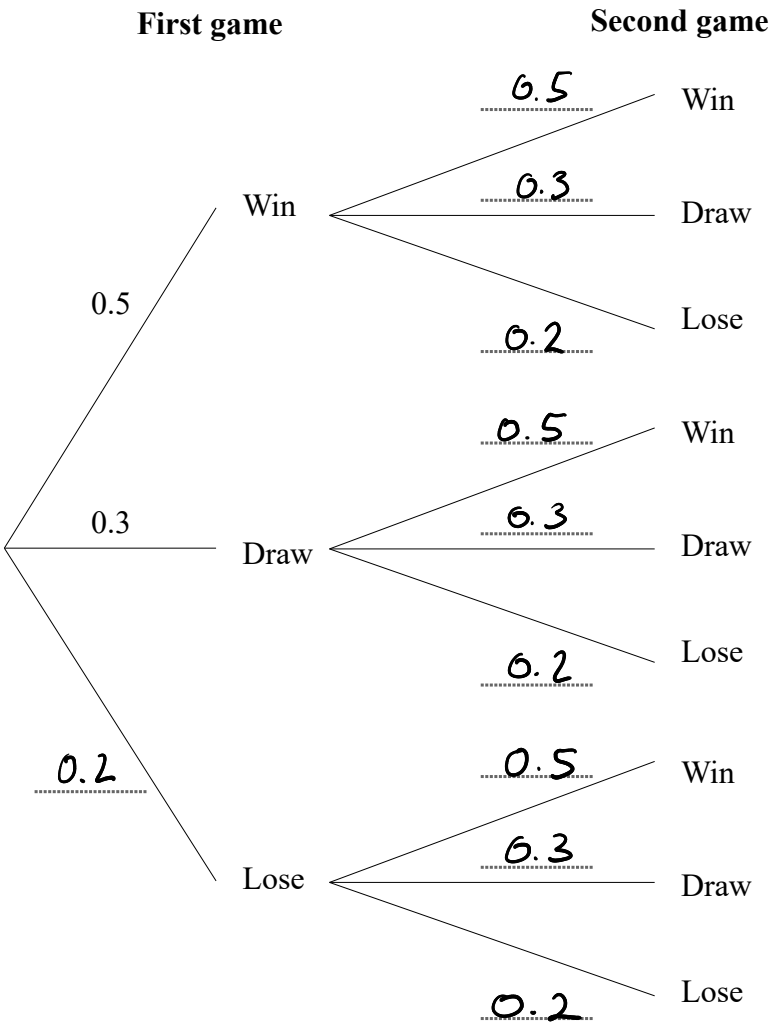
(Total for question 5 is 4 marks)

6 Jon plays a game where he can win, draw or lose.

The probability Jon wins any game 0.5.
The probability Jon draws any game is 0.3

Jon plays two games.

(a) Complete the probability tree diagram



(b) Work out the probability Jon wins both games. (2)

$0.5 \times 0.5 = 0.25$

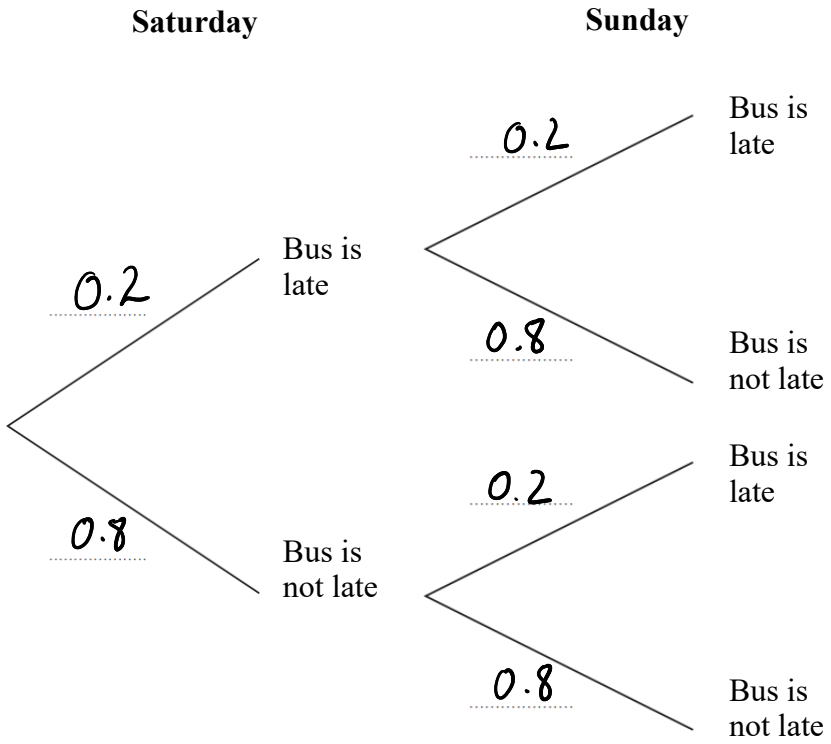
0.25

(2)

(Total for question 6 is 4 marks)

7 Bradley gets the bus on Saturday and Sunday.
The probability that Bradley's bus will be late on any day is 0.2

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Bradley's bus is late on at least one of these days.

Late, Late or Not Late, Late or Late, Not Late

$0.2 \times 0.2 + 0.8 \times 0.2 + 0.2 \times 0.8$

$0.04 + 0.16 + 0.16$

$0.04 + 0.16 + 0.16 = 0.36$

0.36

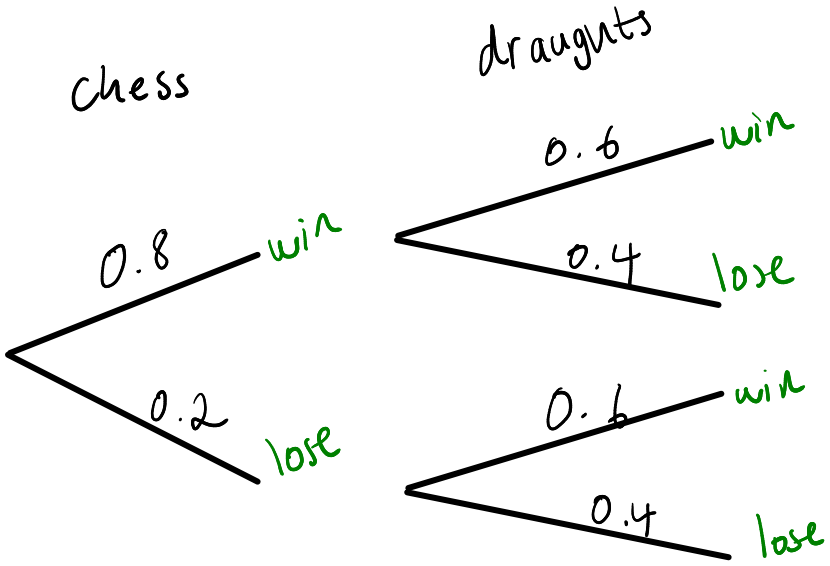
(2)

(Total for question 7 is 4 marks)

8 Felicity is going to play one game of chess and one game of draughts.

The probability she will win the game of chess is 0.8
The probability she will win the game of draughts is 0.6

Work out the probability that Felicity will win exactly one of these games.



win, lose or lose, win

$0.8 \times 0.4 + 0.2 \times 0.6$

$0.32 + 0.12 = 0.44$

0.44

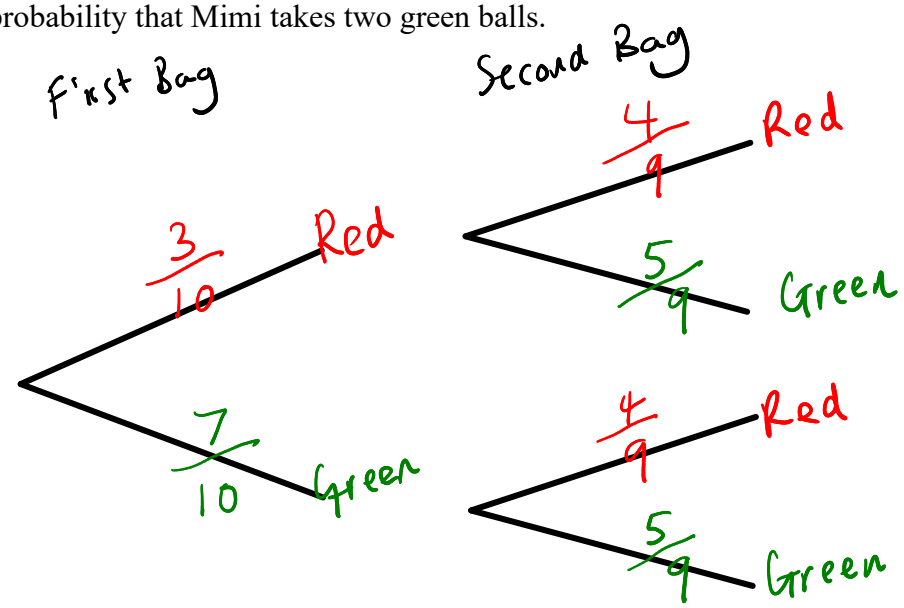
(Total for question 8 is 3 marks)

9 Mimi has two bags.

In the first bag there are 3 red balls and 7 green balls.
In the second bag there are 4 red balls and 5 green balls.

Mimi takes at random a ball from the first bag.
She then takes at random a ball from the second bag.

Work out the probability that Mimi takes two green balls.



$\frac{7}{10} \times \frac{5}{9} = \frac{35}{90}$

$\frac{35}{90}$

(Total for question 9 is 3 marks)

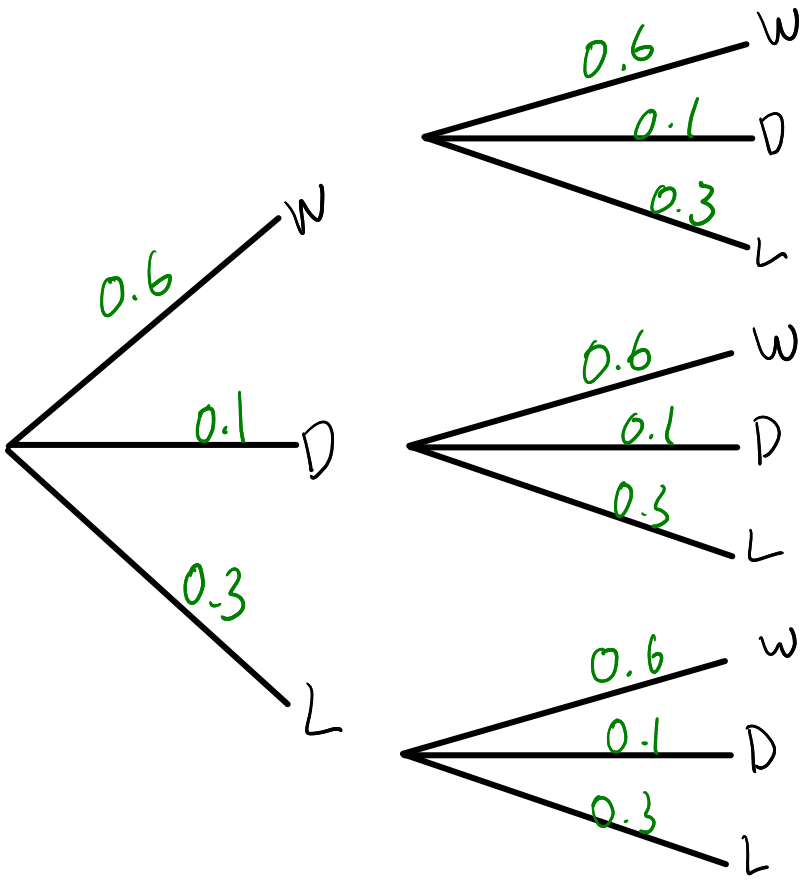
$\left(\frac{7}{18}\right)$

10 Lola plays a game where she can win, draw or lose.

The probability Lola wins any game 0.6
The probability Lola draws any game is 0.1

Lola plays two games.

Work out the probability Lola wins exactly one game.



0.6 × 0.1 = 0.06

0.6 × 0.3 = 0.18

0.1 × 0.6 = 0.06

0.3 × 0.6 = 0.18

win, draw or win, lose or draw, win or lose, win

0.06 + 0.18 + 0.06 + 0.18

0.48

(Total for question 10 is 3 marks)

Name: _____

GCSE (1 – 9)

Vectors

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1 $\boldsymbol{a} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

(a) Write down as a column vector

(i) **a** + **b**

$\begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$\begin{pmatrix} 3 \\ 8 \end{pmatrix}$

.....

(1)

(ii) 2**a** + 3**b**

$2\begin{pmatrix} 2 \\ 3 \end{pmatrix} + 3\begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$\begin{pmatrix} 4 \\ 6 \end{pmatrix} + \begin{pmatrix} 3 \\ 15 \end{pmatrix}$

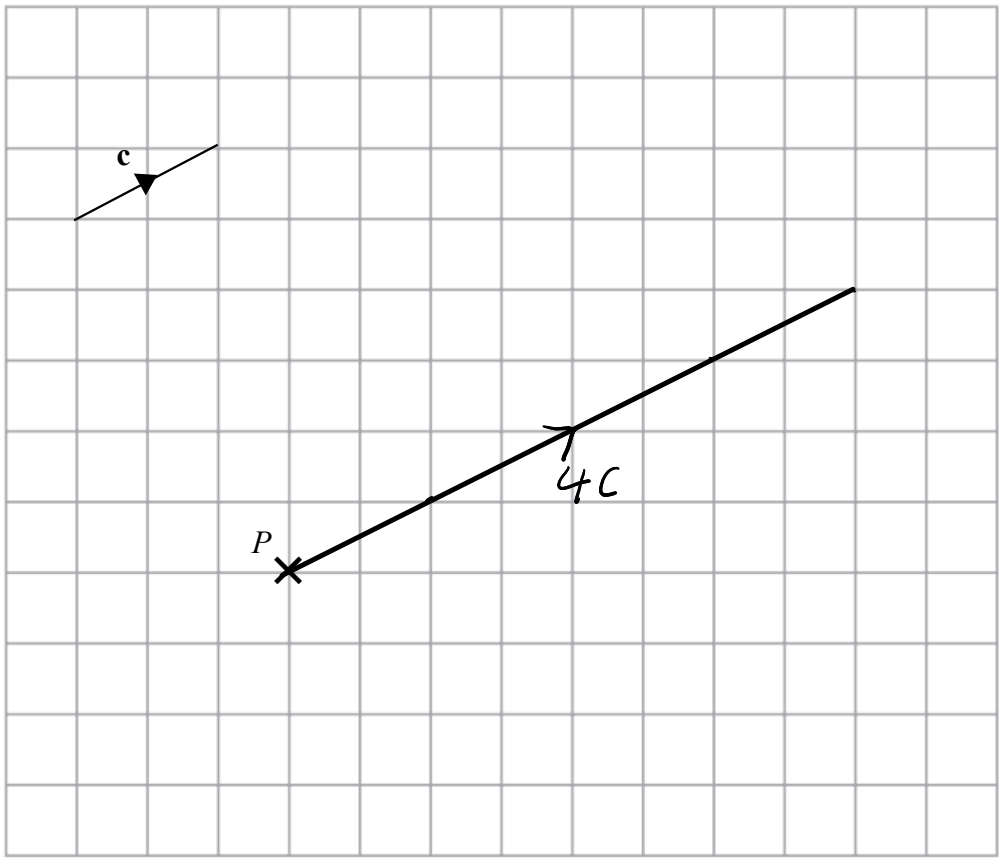
$\begin{pmatrix} 7 \\ 21 \end{pmatrix}$

.....

(2)

The vector **c** is drawn on the grid.

(b) From the point *P*, draw the vector 4**c**



(1)

(Total for question 1 is 4 marks)

2 $\boldsymbol{a} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

(a) Write down as a column vector

(i) **a** + **b**

$\begin{pmatrix} 4 \\ 1 \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

$\begin{pmatrix} 7 \\ 3 \end{pmatrix}$

.....

(1)

(ii) 2**a** – **b**

$2\begin{pmatrix} 4 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

$\begin{pmatrix} 8 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

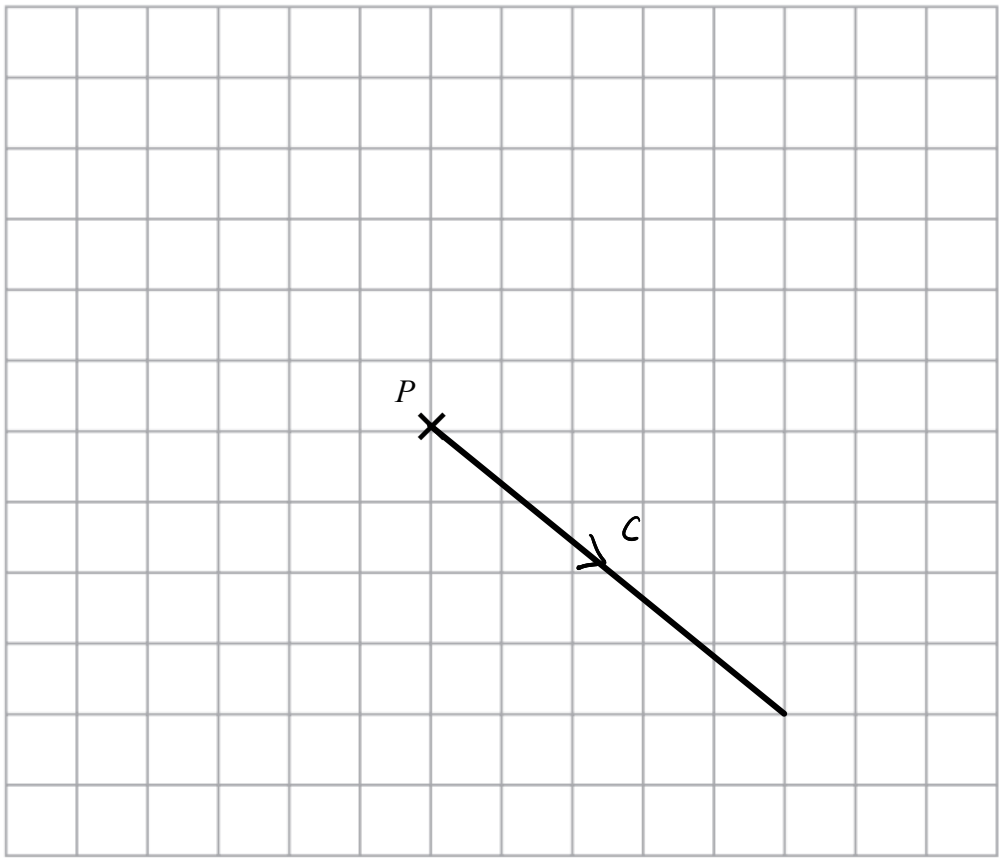
$\begin{pmatrix} 5 \\ 0 \end{pmatrix}$

.....

(2)

$\boldsymbol{c} = \begin{pmatrix} 5 \\ -4 \end{pmatrix}$ right 5 down 4

(b) From the point *P*, draw the vector **c**



(1)

(Total for question 2 is 4 marks)

3 $\boldsymbol{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

(a) Write down as a column vector

(i) **a** + **b**

$\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

$\begin{pmatrix} 3 \\ 2 \end{pmatrix}$

.....

(1)

(ii) 2**a** – **b**

$\begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

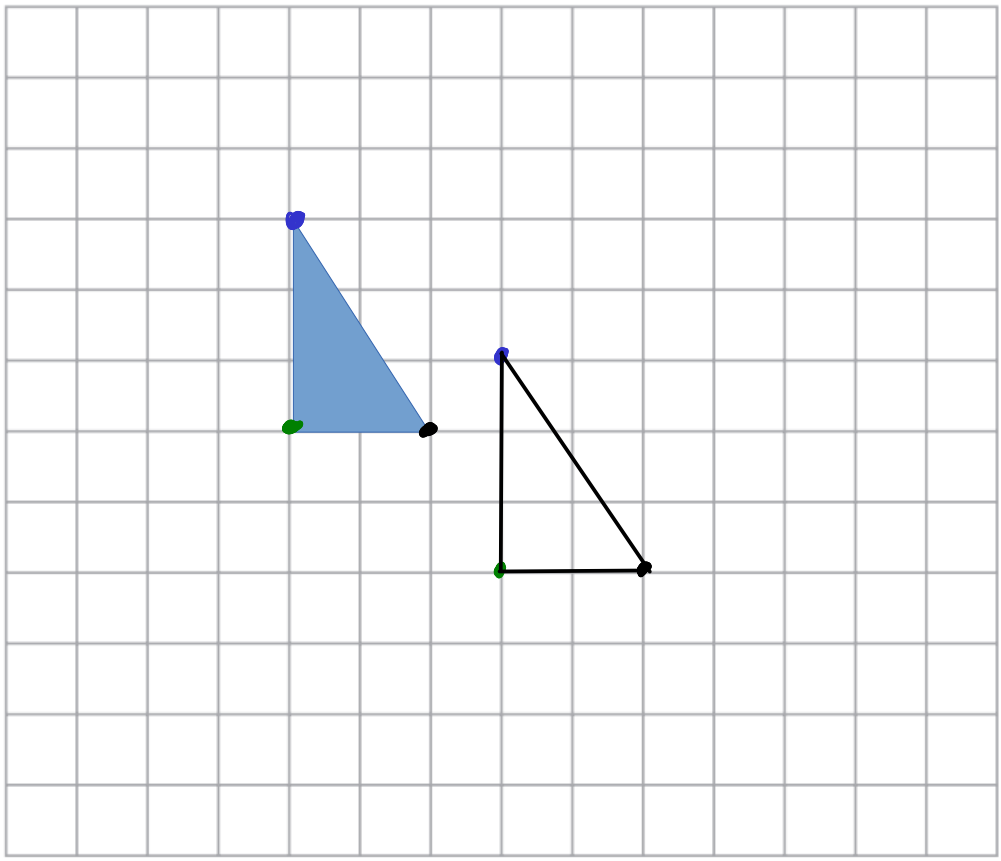
$\begin{pmatrix} -9 \\ 7 \end{pmatrix}$

.....

(2)

(b) Translate the triangle by the vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

3 right
2 down



(1)

(Total for question 3 is 4 marks)

4 A is the point (3, 2) and B is the point (4, –1).

(a) Write down as a column vector $\overrightarrow{AB}$

1 right
3 down

$\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

$\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

(1)

C is the point (5, –2) and D is the point (2, 1).

(b) Write down as a column vector $\overrightarrow{CD}$

3 left
3 up

$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$

$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$

(1)

(Total for question 4 is 2 marks)

---

5 A is the point (5, –1) and B is the point (4, –3).

(a) Write down as a column vector $\overrightarrow{AB}$

1 left
2 down

$\begin{pmatrix} -1 \\ -2 \end{pmatrix}$

(1)

C is the point (1, 6) and D is the point (–3, 9).

(b) Write down as a column vector $\overrightarrow{CD}$

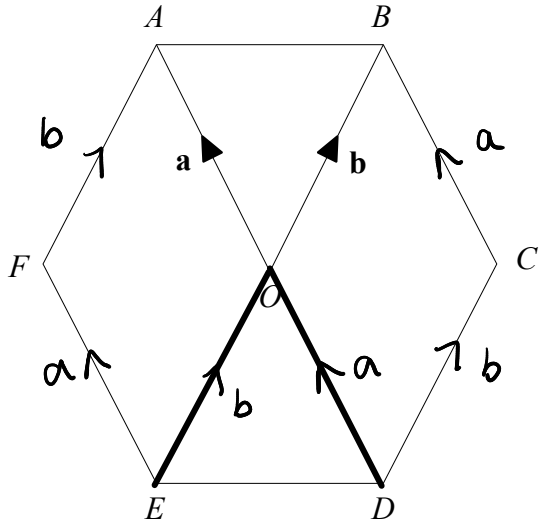
4 left
3 up

$\begin{pmatrix} -4 \\ 3 \end{pmatrix}$

(1)

(Total for question 5 is 2 marks)

6 *ABCDEF* is a regular hexagon with centre *O*.



$\overrightarrow{OA} = \mathbf{a}$

$\overrightarrow{OB} = \mathbf{b}$

(a) Find, in terms of **a**, the vector $\overrightarrow{AD}$

$-2a$

(1)

(b) Find, in terms of **a** and **b**, the vector $\overrightarrow{AB}$

$-a+b$

(1)

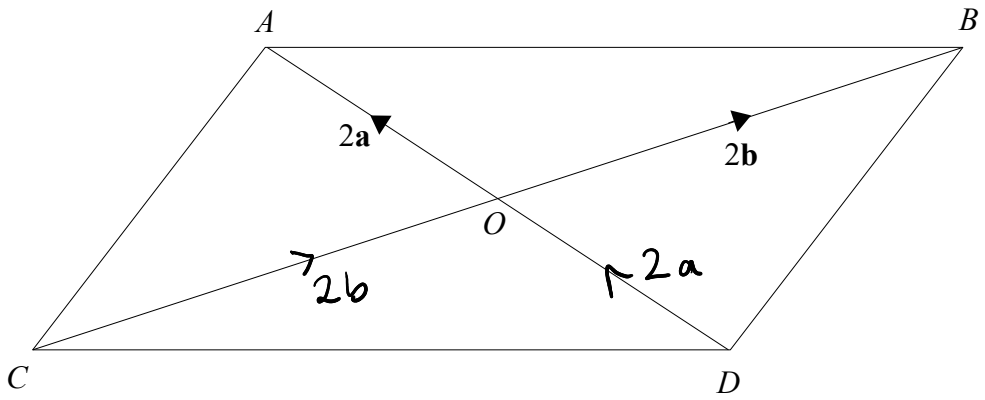
(c) Find, in terms of **b**, the vector $\overrightarrow{AF}$

$-b$

(1)

(Total for question 6 is 3 marks)

7 The diagram shows a parallelogram.



$\overrightarrow{OA} = 2\mathbf{a}$

$\overrightarrow{OB} = 2\mathbf{b}$

(a) Find, in terms of **a**, the vector $\overrightarrow{DA}$

4a

(1)

(b) Find, in terms of **a** and **b**, the vector $\overrightarrow{AB}$

-2a + 2b

(1)

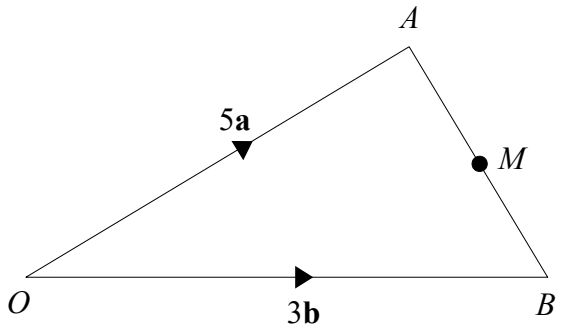
(c) Find, in terms of **a** and **b**, the vector $\overrightarrow{AC}$

-2a - 2b

(1)

(Total for question 7 is 3 marks)

8



$\overrightarrow{OA} = 5\mathbf{a}$

$\overrightarrow{OB} = 3\mathbf{b}$

M is the midpoint of AB

(a) Find, in terms of **a** and **b**, the vector $\overrightarrow{AB}$

$-5a + 3b$

(1)

(b) Find, in terms of **a** and **b**, the vector $\overrightarrow{AM}$

$\frac{1}{2}(-5a + 3b)$ or $-2.5a + 1.5b$

$-\frac{5}{2}a + \frac{3}{2}b$

(1)

(c) Find, in terms of **a** and **b**, the vector $\overrightarrow{OM}$

$\overrightarrow{OA} + \overrightarrow{AM}$

$5a - \frac{5}{2}a + \frac{3}{2}b$

$\frac{5}{2}a + \frac{3}{2}b$ or $2.5a + 1.5b$

(1)

(Total for question 8 is 3 marks)

---

9 $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -1 \\ 5 \end{pmatrix}$

Work out $3\mathbf{a} + \mathbf{b}$ as a column vector.

$\begin{pmatrix} 9 \\ 6 \end{pmatrix} + \begin{pmatrix} -1 \\ 5 \end{pmatrix} = \begin{pmatrix} 8 \\ 11 \end{pmatrix}$

$\begin{pmatrix} 8 \\ 11 \end{pmatrix}$

(Total for Question 9 is 2 marks)

Name: _____

GCSE (1 – 9)

Trigonometry Exact Values

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The marks for each question are shown in brackets
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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

1 Write down the exact value of sin (45)

$\frac{\sqrt{2}}{2}$

(Total for Question 1 is 1 marks)

2 Write down the exact value of cos (90°)

0

(Total for Question 2 is 1 marks)

3 Write down the exact value of tan (30)

$\frac{1}{\sqrt{3}}$ ok $\frac{\sqrt{3}}{3}$

$\frac{\sqrt{3}}{3}$

(Total for Question 3 is 1 marks)

4 Write down the exact value of sin (30°)

$\frac{1}{2}$

(Total for Question 4 is 1 marks)

5 Write down the exact value of tan (45)

1

(Total for Question 5 is 1 marks)

6 Write down the exact value of cos (0°)

1

(Total for Question 6 is 1 marks)

7 Write down the exact value of sin (60)

$\frac{\sqrt{3}}{2}$

(Total for Question 7 is 1 marks)

	0	30	45	60	90
sin	$\sqrt{0}$	$\sqrt{1}$	$\sqrt{2}$	$\sqrt{3}$	$\sqrt{4}$
cos	$\sqrt{4}$	$\sqrt{3}$	$\sqrt{2}$	$\sqrt{1}$	$\sqrt{0}$

2

8 Write down the exact value of sin (0)

0

(Total for Question 8 is 1 marks)

9 Write down the exact value of cos (60°)

$\frac{1}{2}$

(Total for Question 9 is 1 marks)

10 Write down the exact value of tan (0)

0

(Total for Question 10 is 1 marks)

11 Write down the exact value of sin (90°)

1

(Total for Question 11 is 1 marks)

12 Write down the exact value of cos (45)

$\frac{\sqrt{2}}{2}$

(Total for Question 12 is 1 marks)

13 Write down the exact value of tan (60°)

$\sqrt{3}$

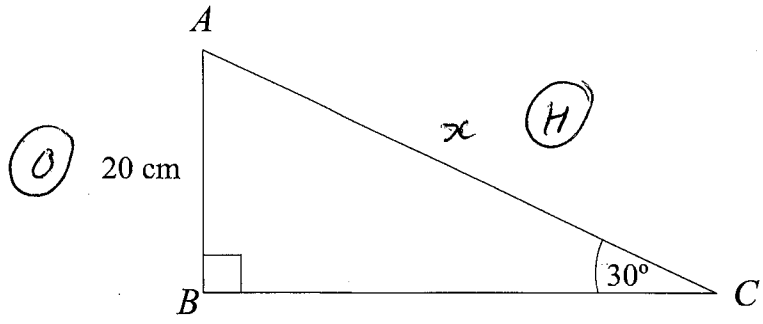
(Total for Question 13 is 1 marks)

14 Write down the exact value of cos (30°)

$\frac{\sqrt{3}}{2}$

(Total for Question 14 is 1 marks)

15



Calculate the length AC.

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

$$\sin 30 = \frac{20}{x}$$

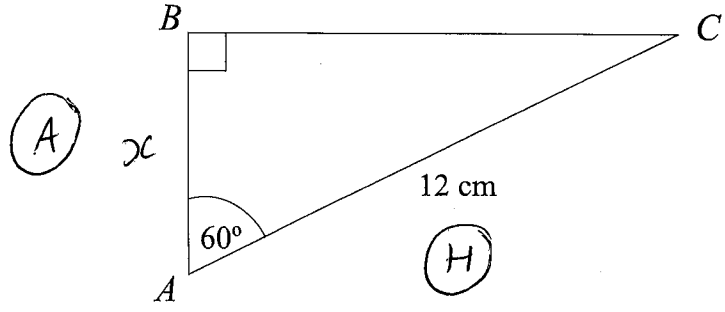
$$\frac{1}{2} = \frac{20}{x}$$

$$x = 40 \text{ cm}$$

40 .....cm

(Total for Question 15 is 3 marks)

16



Calculate the length AB.

$$\cos\theta = \frac{A}{H}$$

$$\cos(60) = \frac{x}{12}$$

$$\frac{1}{2} = \frac{x}{12}$$

$$x = 6 \text{ cm}$$

6 .....cm

(Total for Question 16 is 3 marks)

Name: _____

GCSE (1 – 9)

SOHCAHTOA

Instructions

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- You must **show all your working out.**

Information

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Advice

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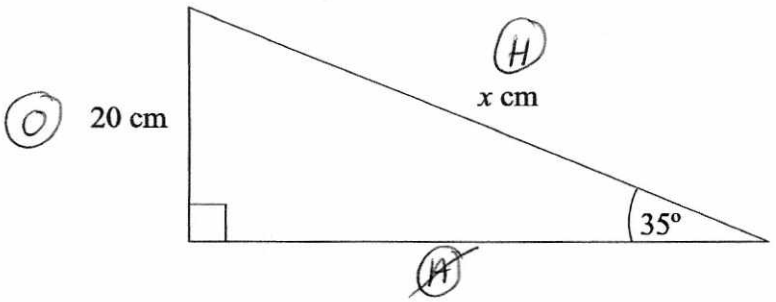
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

SOH ~~CAH~~ ~~TOA~~

1



Work out the value of x.

$$\sin(35) = \frac{20}{x}$$

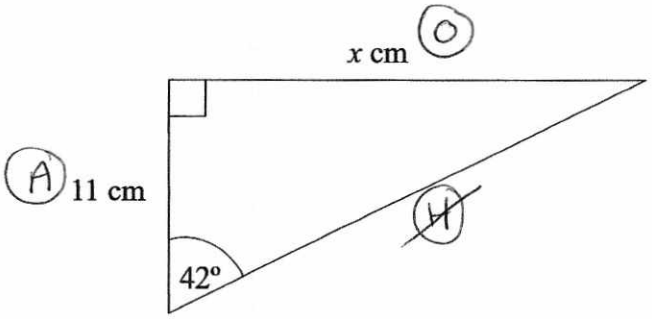
$$x = \frac{20}{\sin(35)}$$

$$= 34.9 \text{ (1dp)}$$

34.9

(Total for question 1 is 2 marks)

2



Work out the value of x.

$$\tan(42) = \frac{x}{11}$$

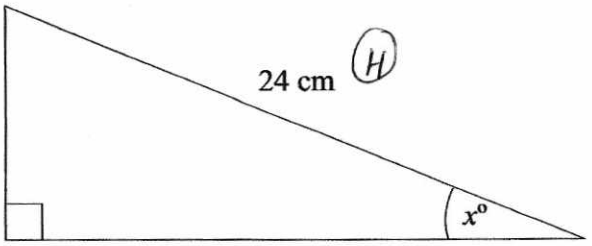
$$x = 11 \times \tan(42)$$

$$= 9.9 \text{ (1dp)}$$

9.9

(Total for question 2 is 2 marks)

3



Work out the value of x.

$\cos x = \frac{16}{24}$

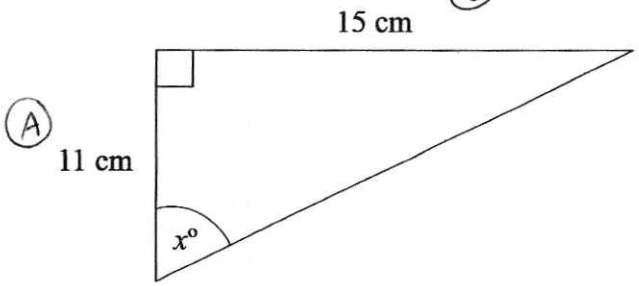
$x = \cos^{-1}\left(\frac{16}{24}\right)$

$= 48.2 \text{ (1dp)}$

48.2

(Total for question 3 is 2 marks)

4



Work out the value of x.

$\tan x = \frac{15}{11}$

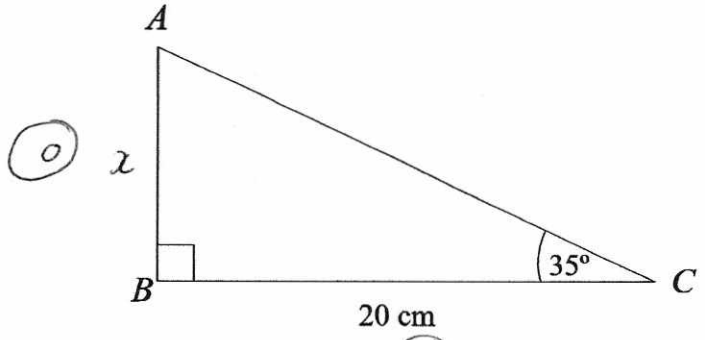
$x = \tan^{-1}\left(\frac{15}{11}\right)$

$= 53.7 \text{ (1dp)}$

53.7

(Total for question 4 is 2 marks)

5



O

A

Calculate the length *AB*.

$$\tan(35) = \frac{x}{20}$$

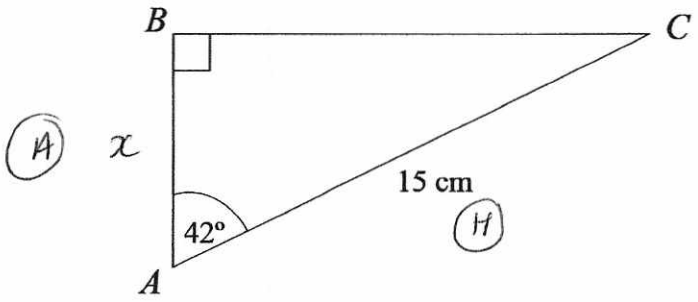
$$x = 20 \times \tan(35)$$

$$= 14.0 \text{ (1dp)}$$

14.0 ..... cm

(Total for question 5 is 2 marks)

6



A

H

Calculate the length *AB*.

$$\cos(42) = \frac{x}{15}$$

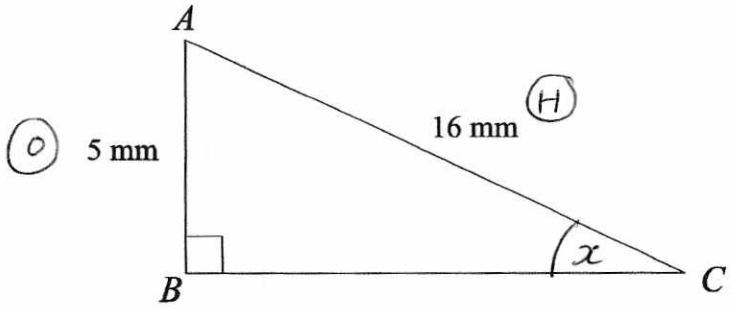
$$x = 15 \times \cos(42)$$

$$= 11.1 \text{ (1dp)}$$

11.1 ..... cm

(Total for question 6 is 2 marks)

7



Calculate the size of angle *ACB*.

$\sin x = \frac{5}{16}$

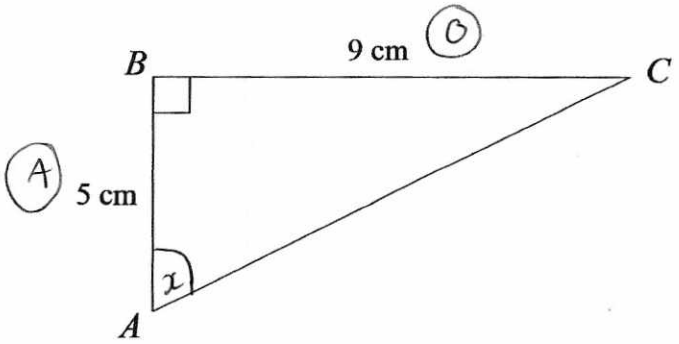
$x = \sin^{-1}\left(\frac{5}{16}\right)$

$= 18.2 \text{ (1dp)}$

18.2 °

(Total for question 7 is 2 marks)

8



Calculate the size of angle *BAC*.

$\tan x = \frac{9}{5}$

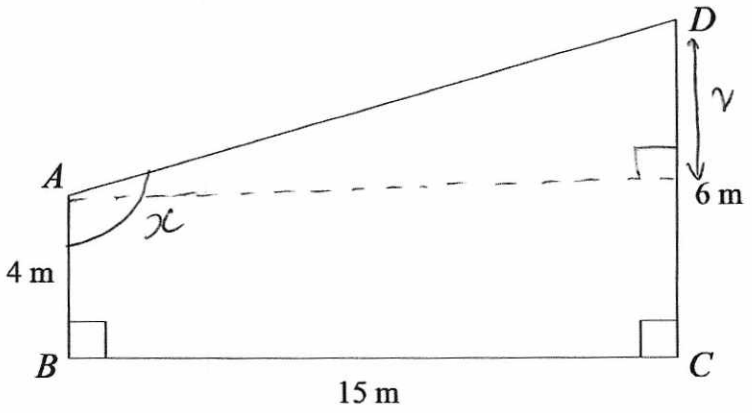
$x = \tan^{-1}\left(\frac{9}{5}\right)$

$= 60.9 \text{ (1dp)}$

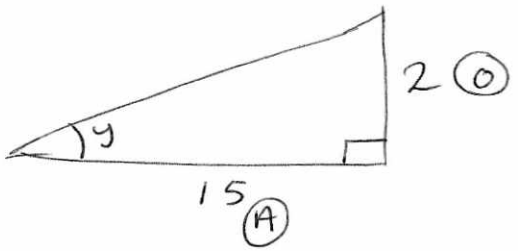
60.9 °

(Total for question 8 is 2 marks)

9



Work out the size of angle *BAD*.
Give your answer to 1 decimal place.



$\tan y = \frac{2}{15}$

$y = \tan^{-1}\left(\frac{2}{15}\right)$

$= 7.6^\circ$ (1 dp)

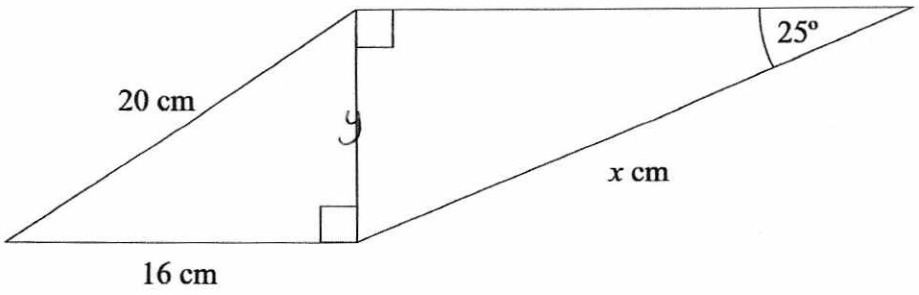
$BAD = 90 + 7.6$

$= 97.6^\circ$

97.6 °

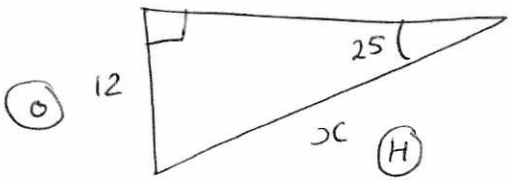
(Total for question 9 is 3 marks)

10



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

$$y^2 + 16^2 = 20^2$$
$$y^2 = 20^2 - 16^2$$
$$y^2 = 144$$
$$y = 12$$

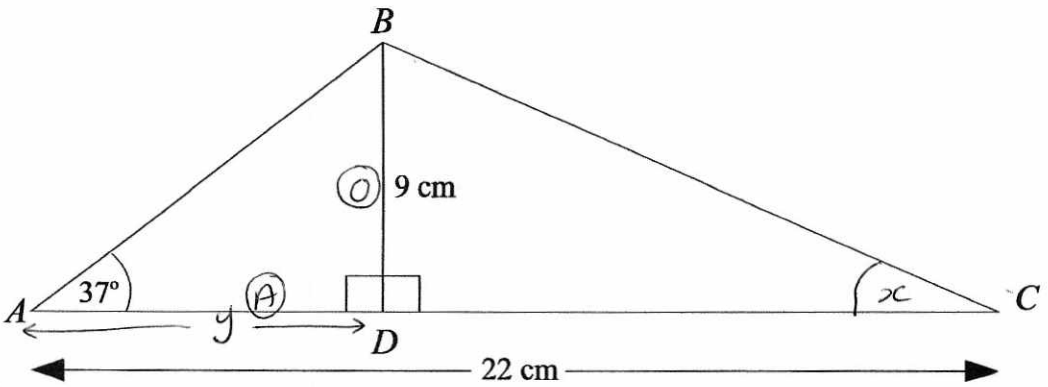


$$\sin(25) = \frac{12}{x}$$
$$x = \frac{12}{\sin(25)}$$
$$= 28.4 \text{ (1dp)}$$

28.4

(Total for question 10 is 4 marks)

11



Work out the size of angle *BCD*.
Give your answer to 1 decimal place.

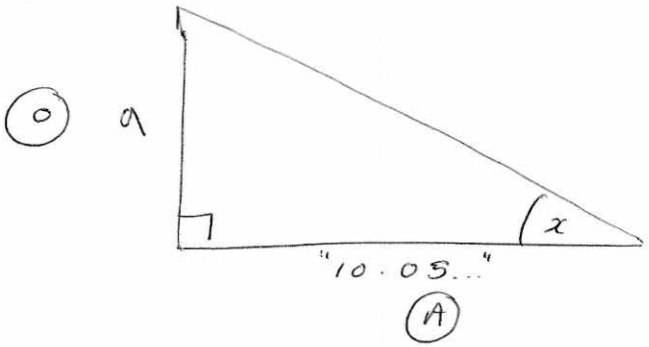
$$\tan(37) = \frac{9}{y}$$

$$y = \frac{9}{\tan(37)}$$

$$= 11.9434...$$

$$CD = 22 - 11.9434$$

$$= 10.05659...$$



$$\tan x = \frac{9}{"10.05..."}$$

$$x = \tan^{-1}\left(\frac{9}{10.05...}\right)$$

$$= 41.8 \text{ 1dp}$$

41.8 °

(Total for question 11 is 4 marks)

Name: _____

GCSE (1 – 9)

Similar Shapes

Instructions

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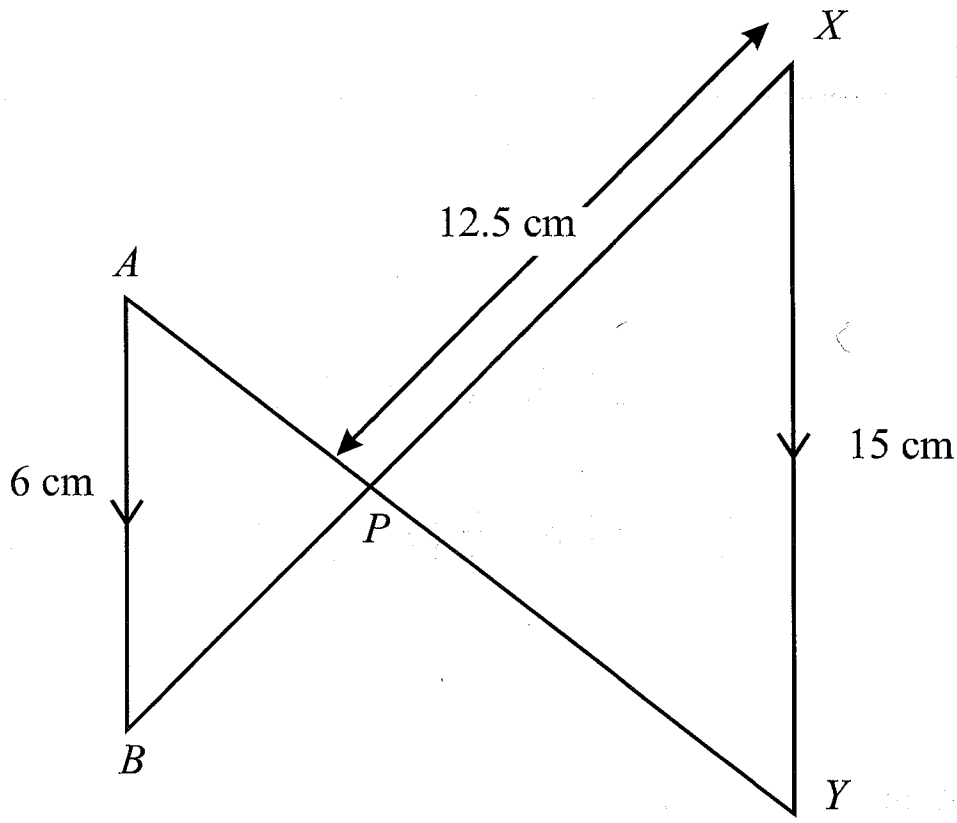
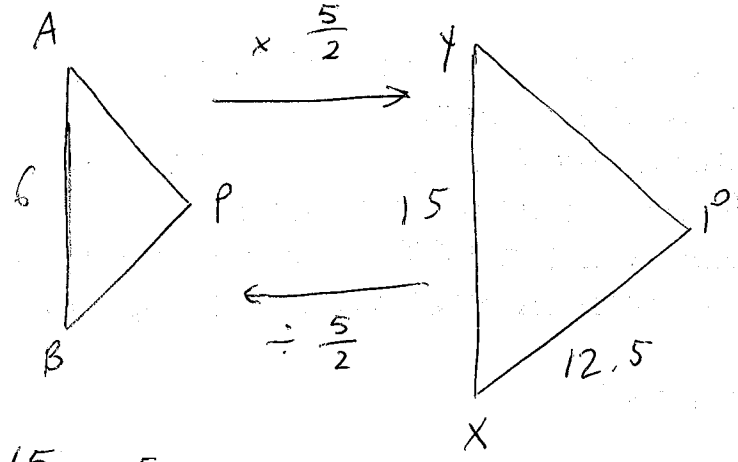
- Keep an eye on the time.
- Try to answer every Question.
- Check your answers if you have time at the end

1



AB is parallel to *XY*.
The lines *AY* and *BX* intersect at *P*.
AB = 6 cm.
XP = 12.5 cm.
XY = 15 cm.

Work out the length of *BP*.



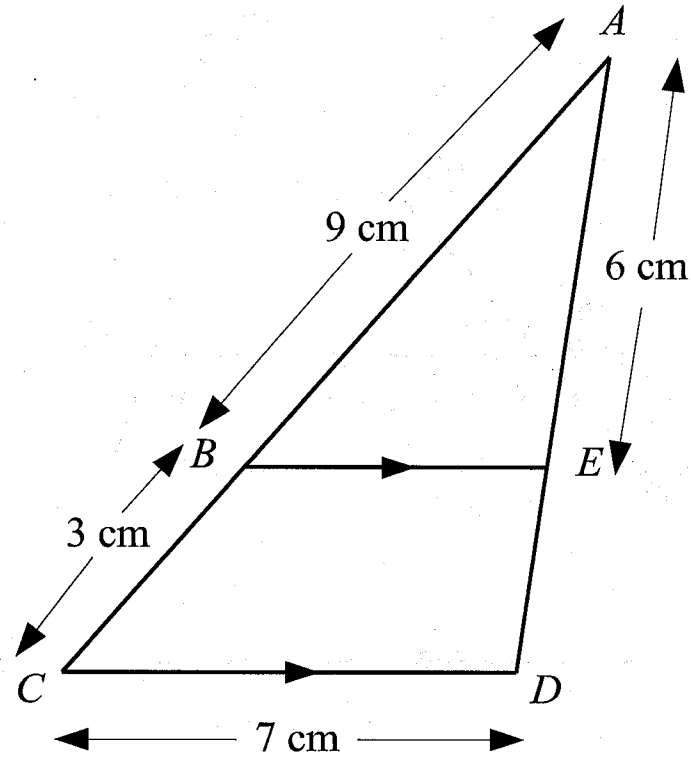
Scale factor = $\frac{15}{6} = \frac{5}{2}$

$12.5 \div \frac{5}{2} = 5$

5 cm

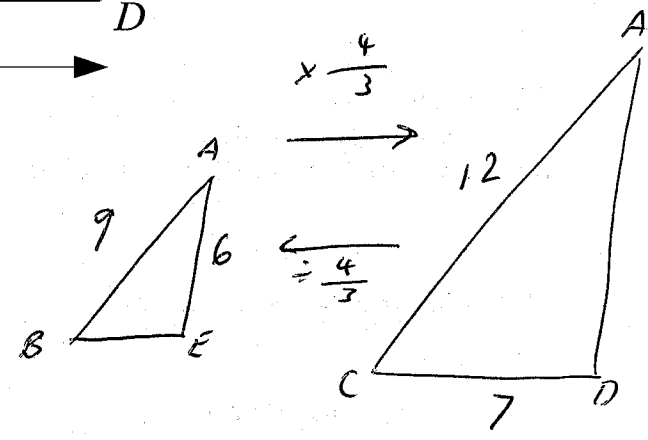
(Total for Question 1 is 3 marks)

1



BE is parallel to *CD*.
AB = 9 cm, *BC* = 3 cm, *CD* = 7 cm, *AE* = 6 cm.

(a) Calculate the length of *ED*.



Scale factor $= \frac{12}{9} = \frac{4}{3}$

$AD = 6 \times \frac{4}{3} = 8\text{cm}$

$ED = 8 - 6 = 2\text{cm}$

2 cm

(2)

(b) Calculate the length of *BE*.

$7 \div \frac{4}{3}$

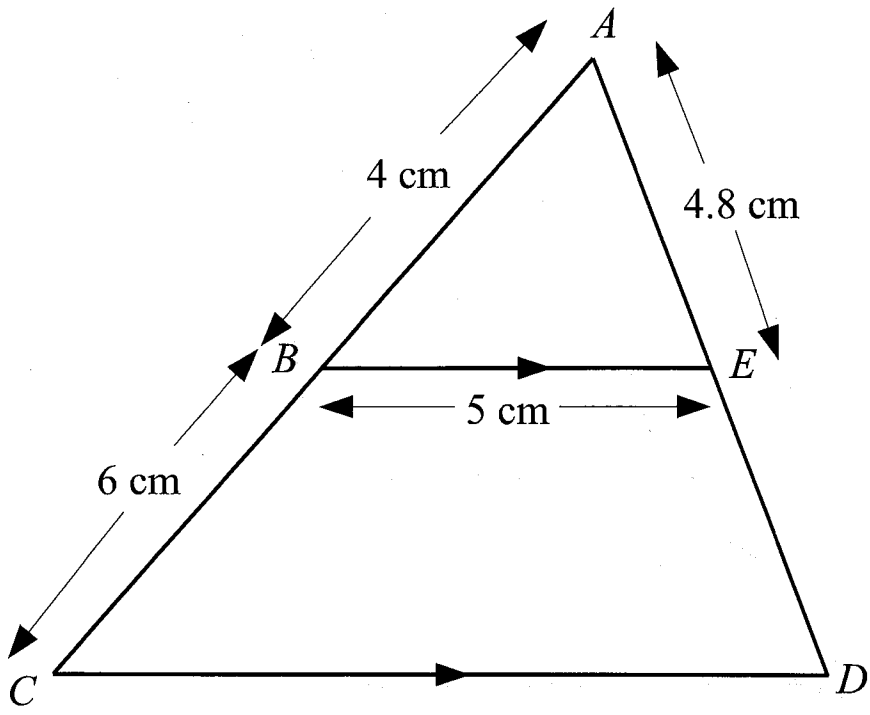
$7 \times \frac{3}{4} = \frac{21}{4}$ OR 5.25

$\frac{21}{4}$ cm

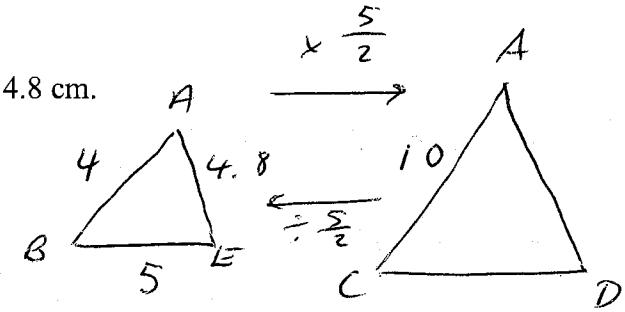
(2)

(Total for Question 1 is 4 marks)

3



BE is parallel to *CD*.
ABC and *AED* are straight lines.
AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.8 cm.



(a) Calculate the length of *CD*.

Scale factor $= \frac{10}{4} = \frac{5}{2}$

$5 \times \frac{5}{2} = \frac{25}{2}$ or 12.5

$\frac{25}{2}$ cm

(2)

(b) Calculate the length of *ED*.

$AD = 4.8 \times \frac{5}{2} = 12$ cm

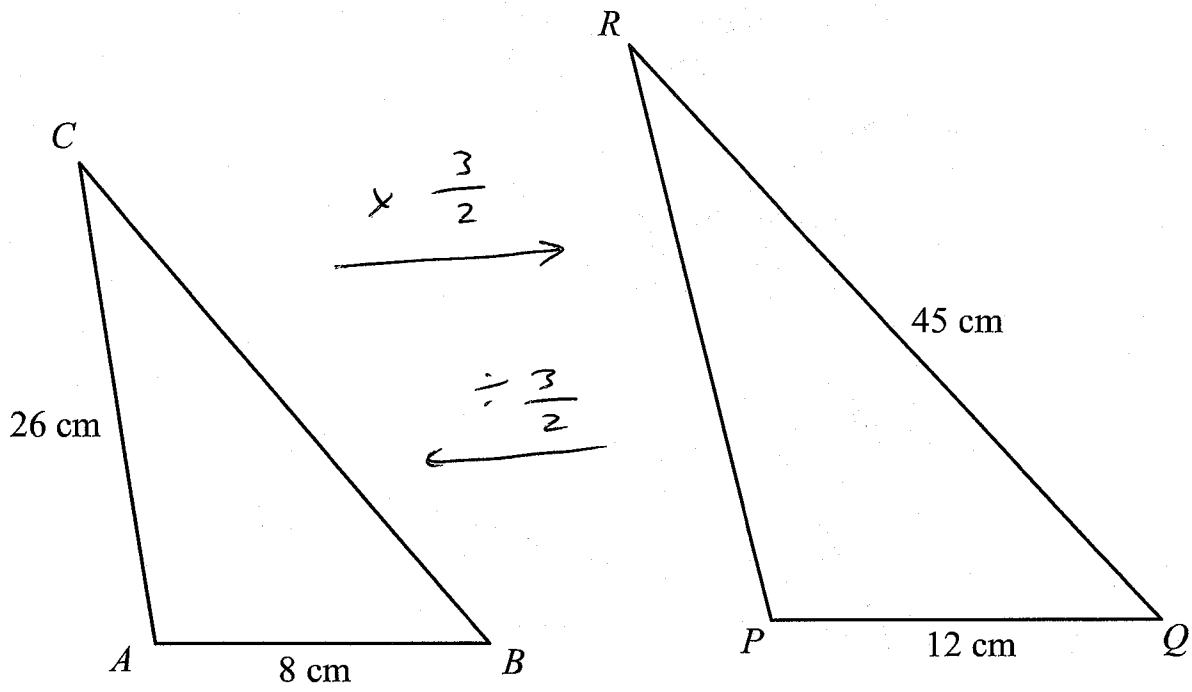
$12 - 4.8 = 7.2$ cm

7.2 cm

(2)

(Total for Question 3 is 4 marks)

4



The two triangles ABC and PQR are mathematically similar.
Angle A = angle P.
Angle B = angle Q.
AB = 8 cm.
AC = 26 cm.
PQ = 12 cm.
QR = 45 cm.

scale factor $= \frac{12}{8} = \frac{3}{2}$

(a) Calculate the length of *PR*.

$26 \times \frac{3}{2} = 39$

39 cm

(2)

(b) Calculate the length of *BC*.

$45 \div \frac{3}{2}$

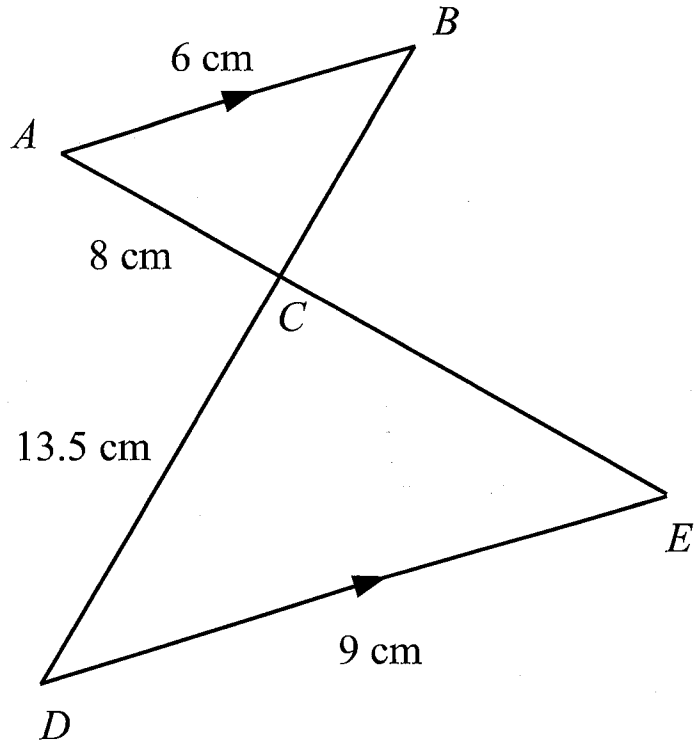
$45 \times \frac{2}{3} = 30$

30 cm

(2)

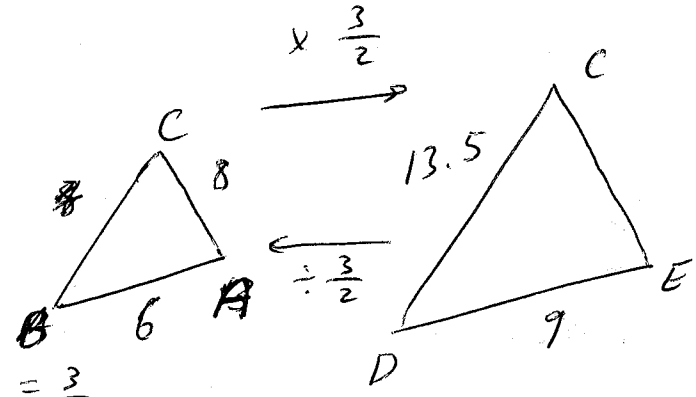
(Total for Question 4 is 4 marks)

5



AB is parallel to *DE*.
ACE and *BCD* are straight lines.
AB = 6 cm,
AC = 8 cm,
CD = 13.5 cm,
DE = 9 cm.

(a) Calculate the length of *CE*.



Scale factor = $\frac{9}{6} = \frac{3}{2}$

$8 \times \frac{3}{2} = 12$

12 cm

(2)

(b) Calculate the length of *BC*.

$13.5 \div \frac{3}{2}$

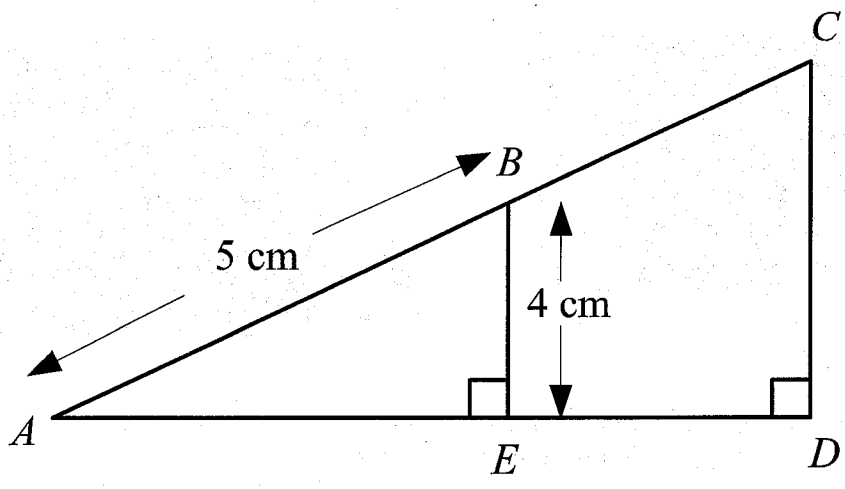
$13.5 \times \frac{2}{3} = 9$

9 cm

(2)

(Total for Question 5 is 4 marks)

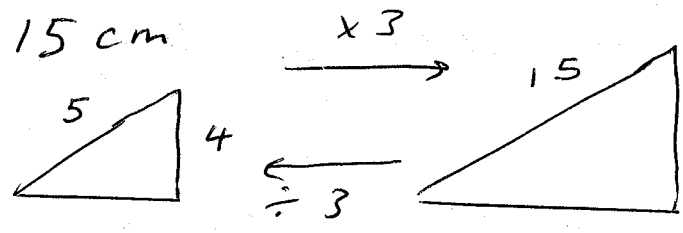
6



AB: AC = 1: 3

AC = 5 × 3

AC = 15 cm



(a) Calculate the length of *CD*.

Scale factor = $\frac{15}{5} = 3$

4 × 3 = 12

12 cm

(2)

(b) Calculate the length of *BC*.

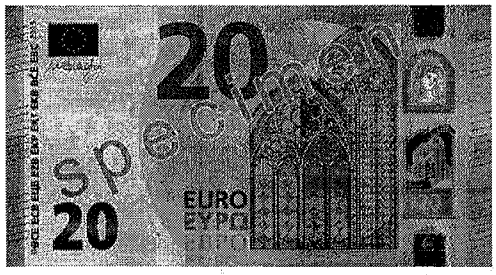
15 − 5 = 10

10 cm

(2)

(Total for Question 6 is 4 marks)

7



A 20 Euro note is a rectangle 133 mm long and 72 mm wide.
A 500 Euro Note is a rectangle 160 mm long and 82 mm wide.

Show that the two rectangles are not mathematically similar.

Scale factor for length $= \frac{160}{133}$

Scale factor for width $= \frac{82}{72} = \frac{41}{36}$

The scale factor for length is not equal to the scale factor for width $\therefore$ they are not similar.

(Total for Question 7 is 3 marks)

Name: _____

GCSE (1 – 9)

Sector Area and Arc Length

Instructions

- Use **black** ink or ball-point pen.
- Answer all Questions.
- Answer the Questions in the spaces provided
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- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

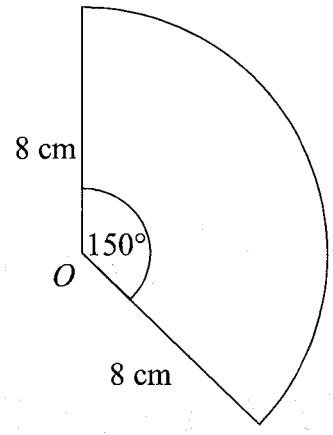
Information

- 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

1 The diagram shows a sector, centre O.
The radius of the circle is 8 cm.
The angle of the sector is 150°.



Calculate the area of the sector.
Give your answer correct to 3 significant figures.

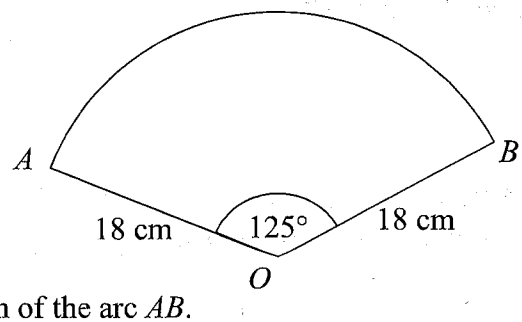
$$\frac{150}{360} \times \pi (8)^2 = 83.8$$

83.8 ..... cm^2

(Total for Question 1 is 2 marks)

---

2 AOB is a sector of a circle, centre O and radius 18 cm.
The angle of the sector is 125°.



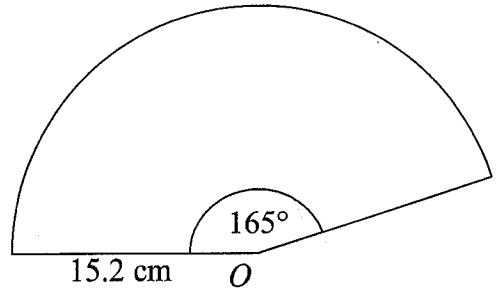
Calculate the length of the arc AB.
Give your answer in terms of π.

$$\frac{125}{360} \times 2\pi (18) = \frac{25}{2}\pi$$

$\frac{25}{2}\pi$ ..... cm

(Total for Question 2 is 2 marks)

3 The diagram shows a sector, centre O.
The radius of the circle is 15.2 cm.
The angle of the sector is 165°.



Calculate the area of the sector.
Give your answer correct to 3 significant figures.

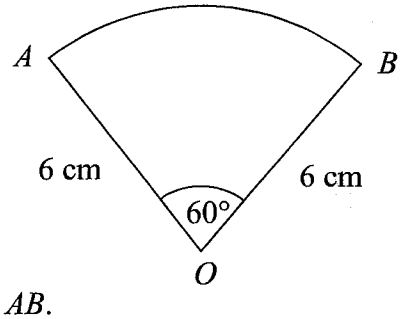
$$\frac{165}{360} \times \pi (15.2)^2 = 333 \text{ cm}^2$$

333 cm²

(Total for Question 3 is 3 marks)

---

4 AOB is a sector of a circle, centre O and radius 6 cm.
The angle of the sector is 60°.



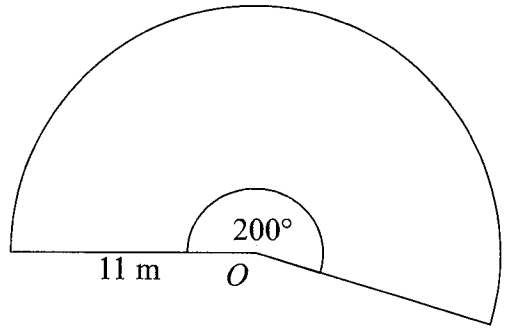
Find the length of the arc AB.
Give your answer in terms of π.

$$\frac{60}{360} \times 2\pi (6) = 2\pi$$

2π cm

(Total for Question 4 is 2 marks)

5 The diagram shows a sector, centre O.
The radius of the circle is 11 m.
The angle of the sector is 200°.



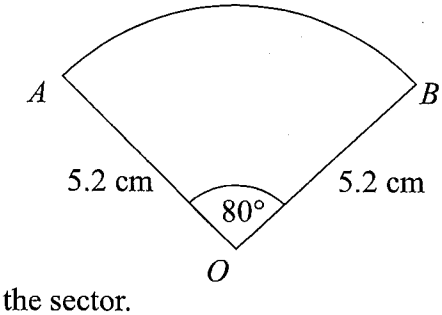
Calculate the area of the sector.
Give your answer correct to 3 significant figures.

$\frac{200}{360} \times \pi(11)^2 = 211 m^2$

211 ..... m^2

(Total for Question 5 is 2 marks)

6 AOB is a sector of a circle, centre O and radius 5.2 cm.
The angle of the sector is 80°.



Find the **perimeter** of the sector.
Give your answer correct to 3 significant figures.

Arc length $= \frac{80}{360} \times 2\pi(5.2)$

$= 7.3$ cm

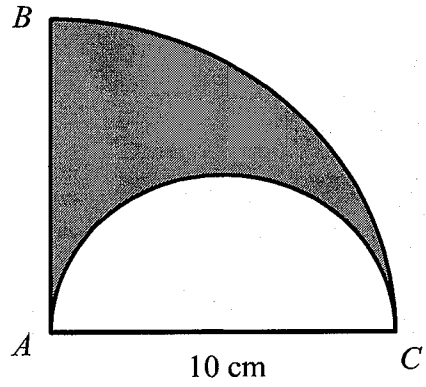
Perimeter $= 5.2 + 5.2 + 7.3$

$= 17.7$ cm

17.7 ..... cm

(Total for Question 6 is 3 marks)

7 *BAC* is a sector of a circle, centre *A*.
AC is the diameter of a semi circle.
AC is 10 cm.



Find the area of the shaded region.
Give your answer in terms of π.

Area of ◠ $= \frac{1}{4}\pi(10)^2$

$= 25\pi$

Area of ⌓ $= \frac{1}{2}\pi(5)^2$

$= 12.5\pi$

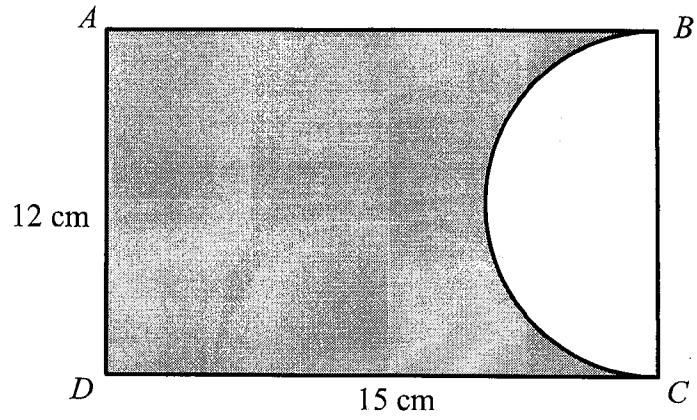
Shaded area $= 25\pi - 12.5\pi$

$= 12.5\pi$

12.5π cm^2

(Total for Question 7 is 4 marks)

8 The diagram shows a rectangle, *ABCD,* and a semi circle.
BC is the diameter of a semi circle.



Calculate the percentage of the area of the rectangle that is shaded.
Give your answer correct to 1 decimal place.

Area of rectangle = 12×15

$= 180 \text{ cm}^2$

Area of semi circle = $\frac{1}{2} \pi (6)^2$

$= 18\pi \text{ cm}^2$

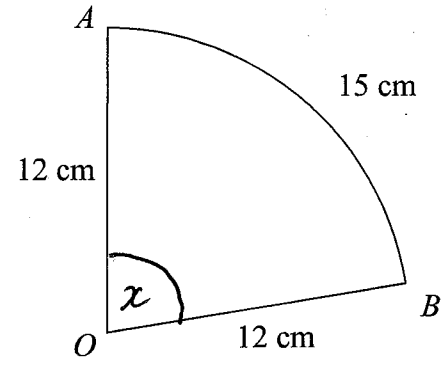
Shaded area = $180 - 18\pi$

$= 123.45 \text{ cm}^2$

$\frac{123.45}{180} \times 100 = 68.6\%$ 68.6 %

(Total for Question 1 is 8 marks)

9 AOB is a sector of a circle, centre O and radius 12 cm.
The length of arc AB is 15 cm.



Find the area of the sector.
~~Give your answer correct to 3 significant figures~~

$$\text{Arc length} = \frac{x}{360} \times 2\pi r$$

$$15 = \frac{x}{360} \times 2\pi (12)$$

$$5400 = x \times 24\pi$$

$$x = \frac{5400}{24\pi}$$

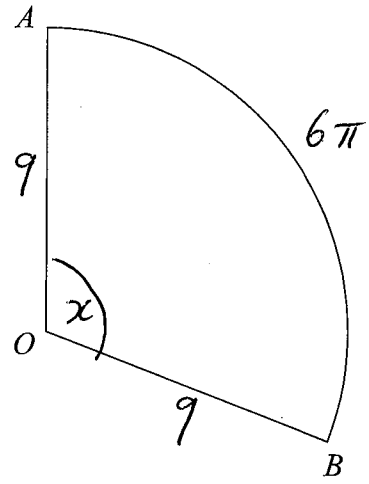
$$= 71.6^\circ$$

$$\frac{"71.6"}{360} \times \pi (12)^2 = 90$$

90 ..... cm^2

(Total for Question 9 is 4 marks)

10 AOB is a sector of a circle, centre O and radius 9 cm.
The length of arc AB is 6π cm.



Find the area of the sector.
Give your answer in terms of π.

$$\frac{x}{360} \times 2\pi(9) = 6\pi$$

$$\frac{18x}{360} = 6$$

$$x = \frac{6 \times 360}{18}$$

$$= 120^\circ$$

$$\text{Area} = \frac{120}{360} \times \pi(9)^2$$

$$= 27\pi \text{ cm}^2$$

27π ..... cm^2

(Total for Question 10 is 4 marks)

Name: _____

GCSE (1 – 9)

Spheres and Cones

Instructions

- Use **black** ink or ball-point pen.
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- Answer the Questions in the spaces provided
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Information

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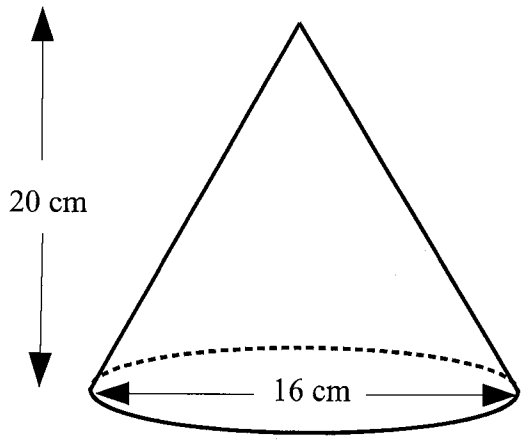
Advice

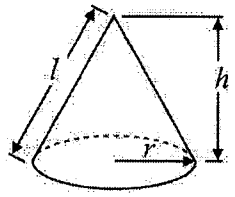
- Read each Question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every Question.
- Check your answers if you have time at the end

1 The diagram shows a cone.



Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



The height of the cone is 20 cm.
The base of the cone has a diameter of 16 cm. $r = 8$ cm

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

$$\text{volume} = \frac{1}{3}\pi r^2 h$$

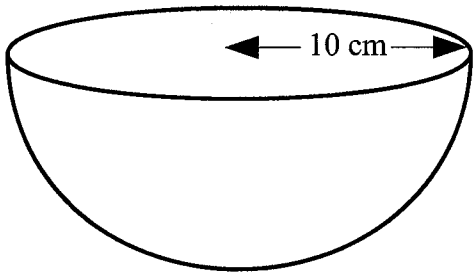
$$= \frac{1}{3}\pi (8)^2 (20)$$

$$= 1340 \text{ cm}^3$$

1340 cm^3

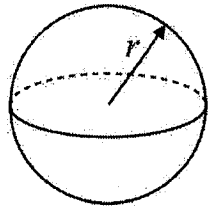
(Total for Question 1 is 2 marks)

2 The diagram shows a solid hemisphere with a radius of 10 cm.



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

Surface area of sphere $= 4\pi r^2$



Work out the total surface area of the hemisphere.
Give your answer in terms of π.

Area of circle $= \pi (10)^2$

$= 100\pi$

Curved area $= \frac{4\pi (10)^2}{2}$

$= 200\pi$

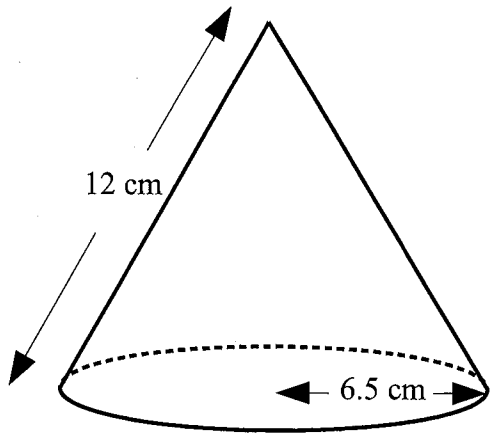
$100\pi + 200\pi = 300\pi$

300π cm^2

(Total for Question 2 is 3 marks)

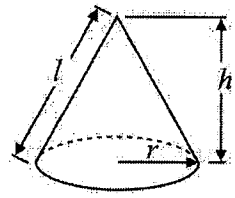
Solid

3 The diagram shows a cone.



Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



The slanted height of the cone is 12 cm.
The base of the cone has a radius of 6.5 cm.

Work out the total surface area of the cone.
Give your correct to 3 significant figures.

Curved surface area $= \pi(6.5)(12)$

$= 78\pi$

area of circle $= \pi(6.5)^2$

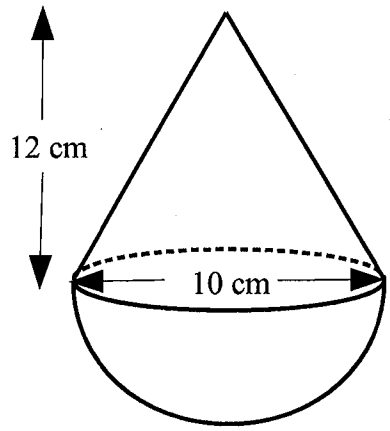
$= \frac{169}{4}\pi$

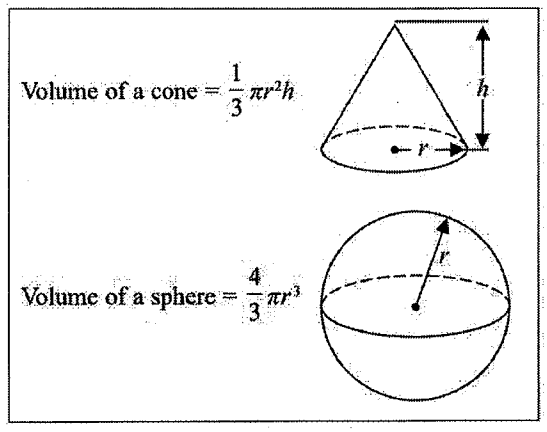
$78\pi + \frac{169}{4}\pi = 378 \text{ cm}^2$

378 cm^2

(Total for Question 3 is 3 marks)

4 The diagram shows a solid shape.
The shape is a cone on top of a hemisphere.





The height of the cone is 12 cm.
The base of the cone has a diameter of 10 cm. $r = 5$
The diameter of the hemisphere is 10 cm.

Work out the total volume of the solid shape.
Give your answer in terms of π.

volume of cone $= \frac{1}{3}\pi(5)^2(12)$

$= 100\pi$

volume of hemisphere $= \frac{2}{3}\pi(5)^3$

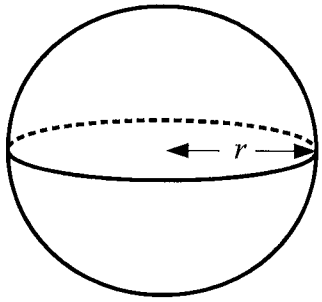
$= \frac{250}{3}\pi$

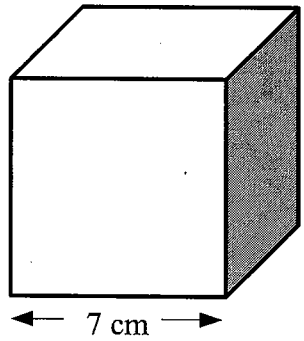
total volume $= 100\pi + \frac{250}{3}\pi$

$= \frac{550}{3}\pi$ $\frac{550}{3}\pi$ cm^3

(Total for Question 4 is 4 marks)

5 The diagram shows a sphere and a cube.





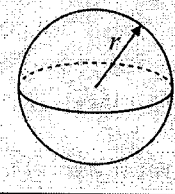
The cube has length 7 cm.

The sphere and the cube have the same volume.
Work out the radius of the sphere.

Give your answer correct to 3 significant figures.

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

Surface area of sphere $= 4\pi r^2$



volume of cube = $7 \times 7 \times 7$

$= 343 \text{ cm}^3$

$\frac{4}{3}\pi r^3 = 343$

$4\pi r^3 = 1029$

$r^3 = \frac{1029}{4\pi}$

$r^3 = 81.885...$

$r = \sqrt[3]{81.885}$

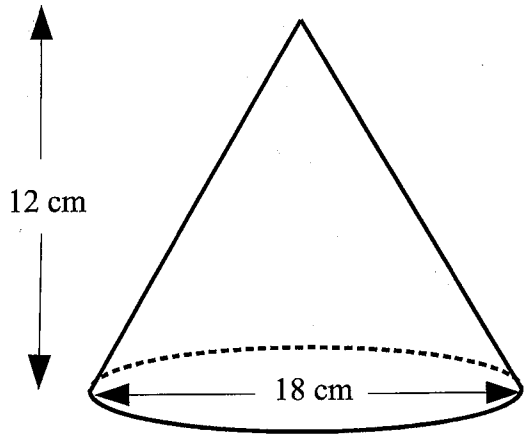
$= 4.34 \text{ cm}$

4.34 cm

(Total for Question 5 is 3 marks)

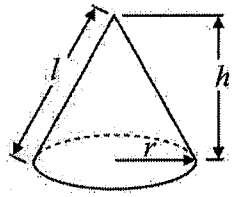
solid

6 The diagram shows a cone.



Volume of cone $= \frac{1}{3}\pi r^2 h$

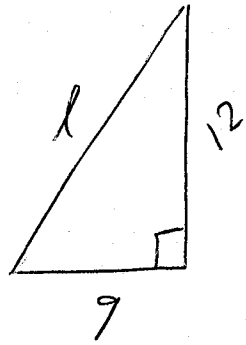
Curved surface area of cone $= \pi r l$



The height of the cone is 12 cm.
The base of the cone has a diameter of 18 cm.

Work out the total surface area of the cone.
Give your answer in terms of π.

$r = 9\text{cm}$



$l^2 = 9^2 + 12^2$

$l^2 = 225$

$l = \sqrt{225}$

$= 15\text{cm}$

Area of circle $= \pi(9)^2$

$= 81\pi$

Curved area $= \pi(9)(15)$

$= 135\pi$

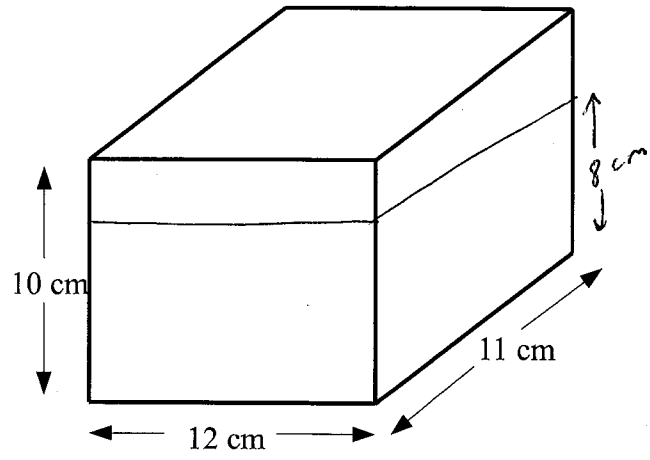
Total surface area $= 81\pi + 135\pi$

$= 216\pi$

$216\pi \text{ cm}^2$

(Total for Question 6 is 4 marks)

7



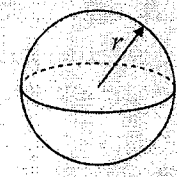
A rectangular container is 12 cm long, 11 cm wide and 10 cm high.
The container is filled with water to a depth of 8 cm.

A metal sphere of radius 3.5 cm is placed in the water.
It sinks to the bottom.

Calculate the rise in the water level.
Give your answer correct to 3 significant figures

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

Surface area of sphere $= 4\pi r^2$



volume of sphere $= \frac{4}{3}\pi(3.5)^3$

$= \frac{343}{6}\pi \text{ cm}^3$

volume of water $= 12 \times 11 \times 8$

$= 1056 \text{ cm}^3$

Total volume $= 1235.59 \text{ cm}^3$

$12 \times 11 \times h = 1235.59$

$h = \frac{1235.59}{12 \times 11}$

$= 9.36 \text{ cm}$

$9.36 - 8$

$= 1.36 \text{ cm}$

1.36 cm

(Total for Question 7 is 4 marks)

Name: _____

GCSE (1 – 9)

The Equation of a Line

Instructions

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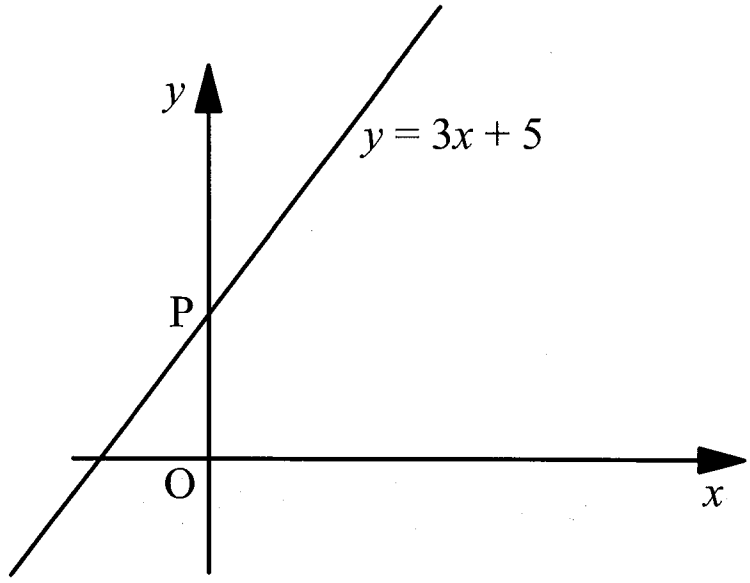
- Check your answers if you have time at the end

1



(a) The line $y = 3x + 5$ crosses the y axis at P.
What is the value of y at P?

5

(1)

(b) Write down the equation of another line which is parallel to $y = 3x + 5$

Any other line with $m = 3$

$y = 3x + 1$

(1)

(Total for Question 1 is 2 marks)

---

2 A line passes through the point (0, 4).
The gradient of this line is 2.
Write down the equation of this line.

$y = 2x + 4$

(Total for Question 2 is 2 marks)

---

3 A line passes through the point (0, -5).
The gradient of this line is 3.
Write down the equation of this line.

$y = 3x - 5$

(Total for Question 3 is 2 marks)

4 A straight line has equation $y = 5 - 3x$

(a) Write down the gradient of the line.

-3

(1)

(b) Write down the coordinates of the point where the line crosses the y axis.

$(0, 5)$

(1)

(Total for Question 4 is 2 marks)

---

5 A straight line has equation $y = 3x - 2$

(a) Write down the gradient of the line.

3

(1)

(b) Write down the coordinates of the point where the line crosses the y axis.

$(0, -2)$

(1)

(Total for Question 5 is 2 marks)

---

6 A straight line has equation $y = 2 - x$

(a) Write down the gradient of the line.

-1

(1)

(b) Write down the coordinates of the point where the line crosses the y axis.

$(0, 2)$

(1)

(Total for Question 6 is 2 marks)

---

7 A straight line has equation $y = 4x + 3$

(a) Write down the gradient of the line.

4

(1)

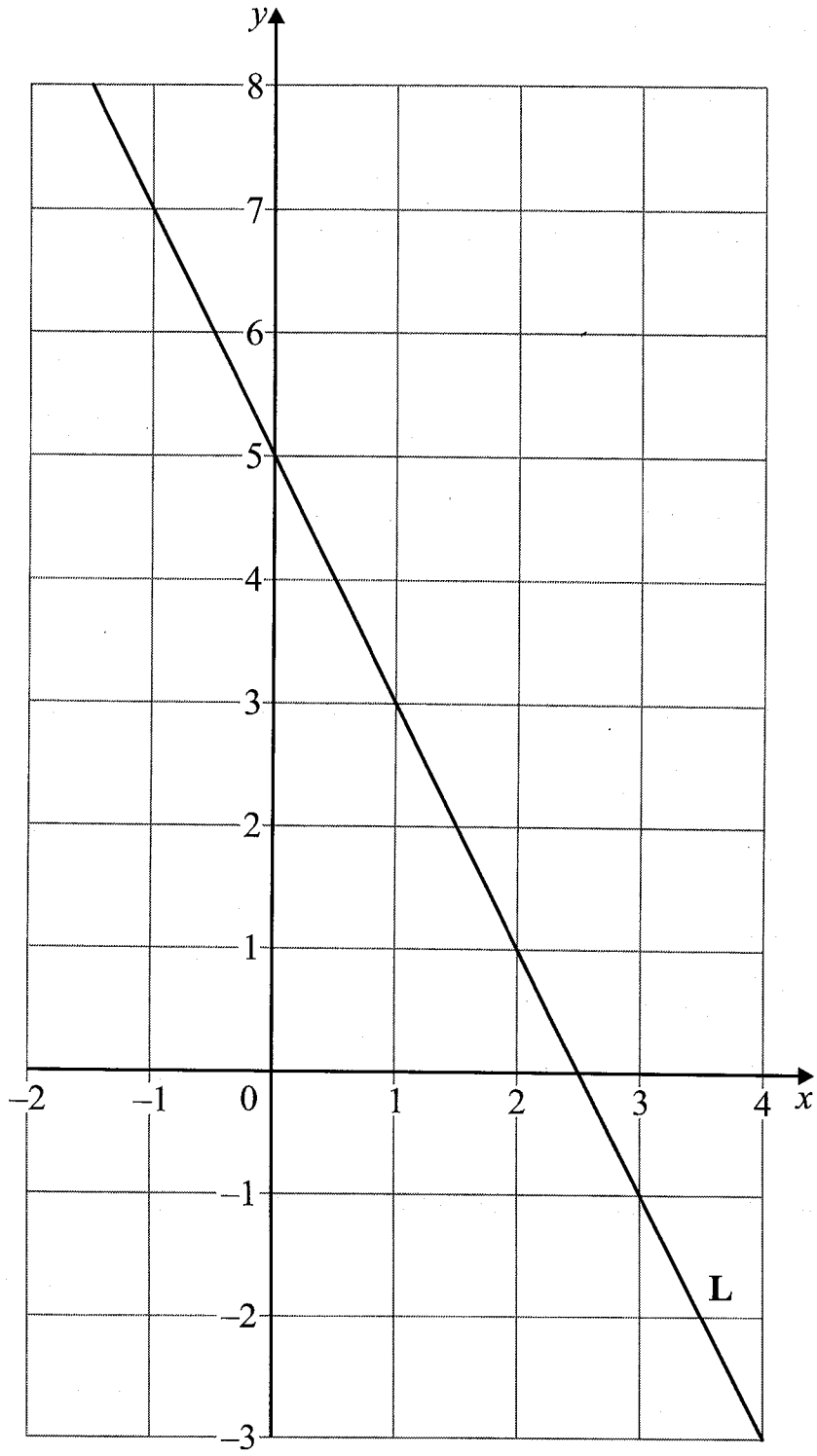
(b) Write down the coordinates of the point where the line crosses the y axis.

$(0, 3)$

(1)

(Total for Question 7 is 2 marks)

8



Find the equation of line L.

$y = -2x + 5$

(Total for Question 8 is 3 marks)

9 A straight line has equation $2y - 10x = 8$

(a) Work out the gradient of this line.

$y - 5x = 4$

$y = 5x + 4$

5

(2)

(b) Write down the equation of a line parallel to this line.

Any other line with $m = 5$ $y = 5x + 1$

(1)

(Total for Question 9 is 3 marks)

---

10 A straight line has equation $4y - 5x = 2$

(a) Work out the gradient of this line.

$4y = 5x + 2$

$y = \frac{5}{4}x + \frac{1}{2}$

$\frac{5}{4}$

(2)

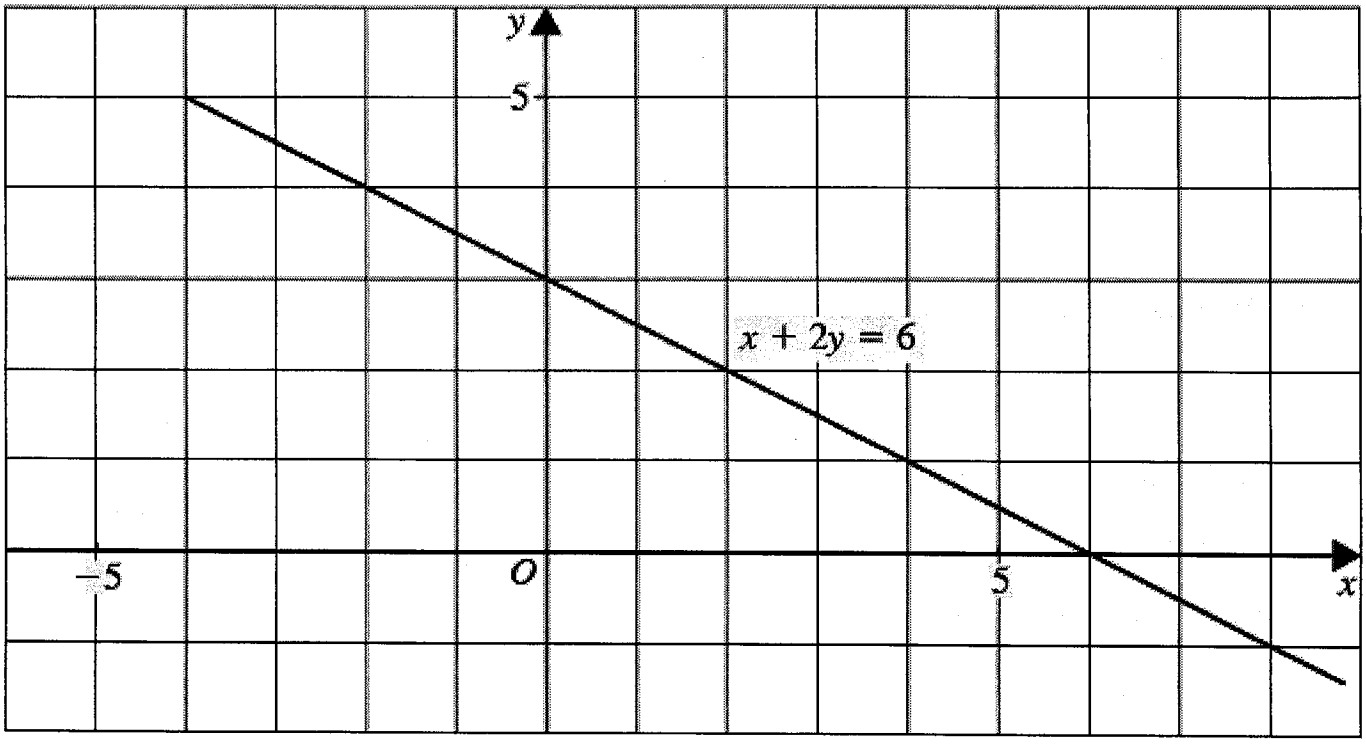
(b) Write down the equation of a line parallel to this line.

Any other line with $m = \frac{5}{4}$ $y = \frac{5}{4}x + 1$

(1)

(Total for Question 10 is 3 marks)

11 The line with equation $x + 2y = 6$ has been drawn on the grid.



(a) Rearrange the equation $x + 2y = 6$ to make y the subject.

$2y = -x + 6$

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

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

(2)

(b) Write down the gradient of the line with equation $x + 2y = 6$

$-\frac{1}{2}$

(2)

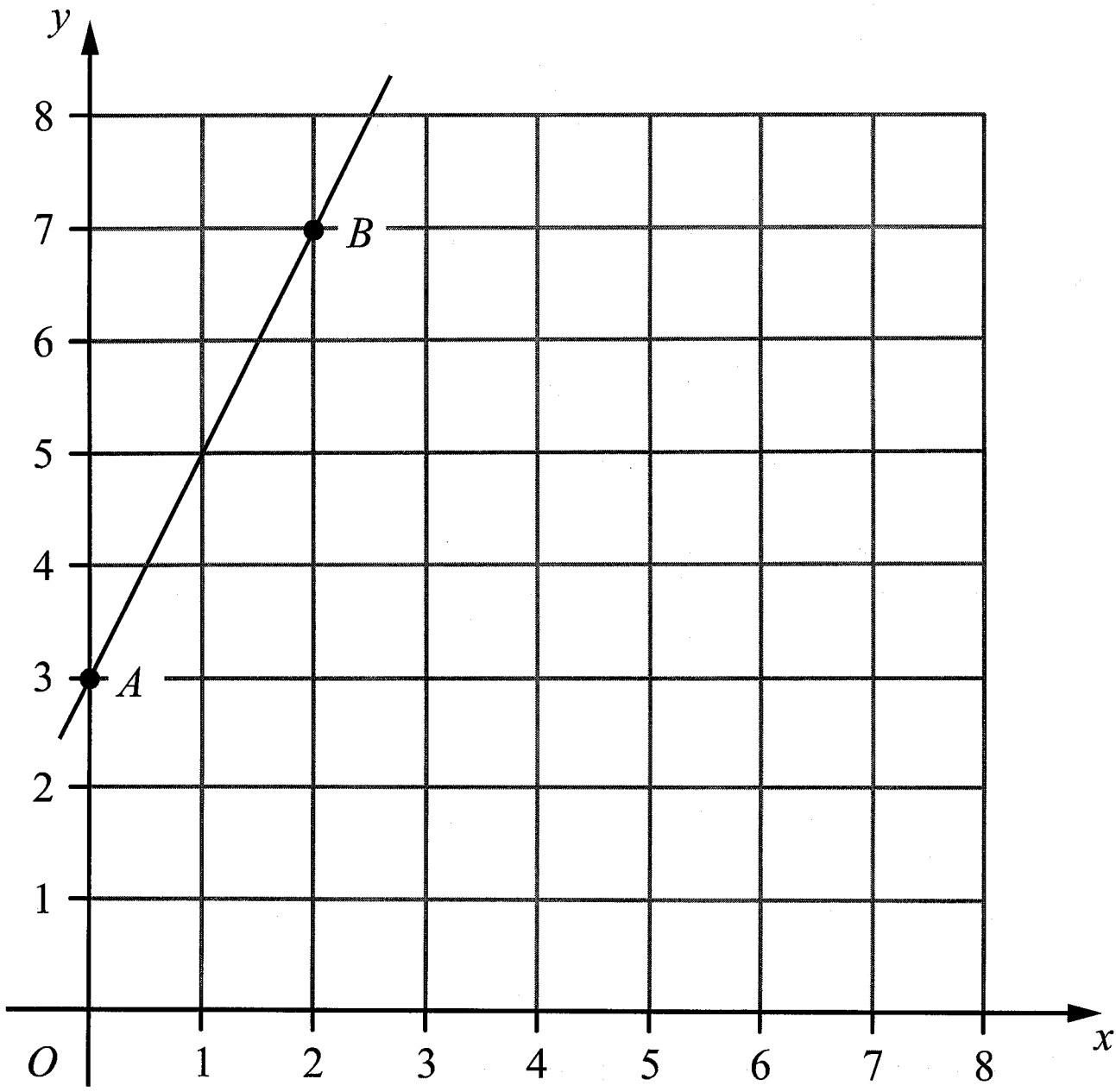
(c) Write down the equation of the line which is parallel to the line with equation $x + 2y = 6$ and passes through the point with coordinates (0, 7).

$y = -\frac{1}{2}x + 7$

(1)

(Total for Question 11 is 5 marks)

12

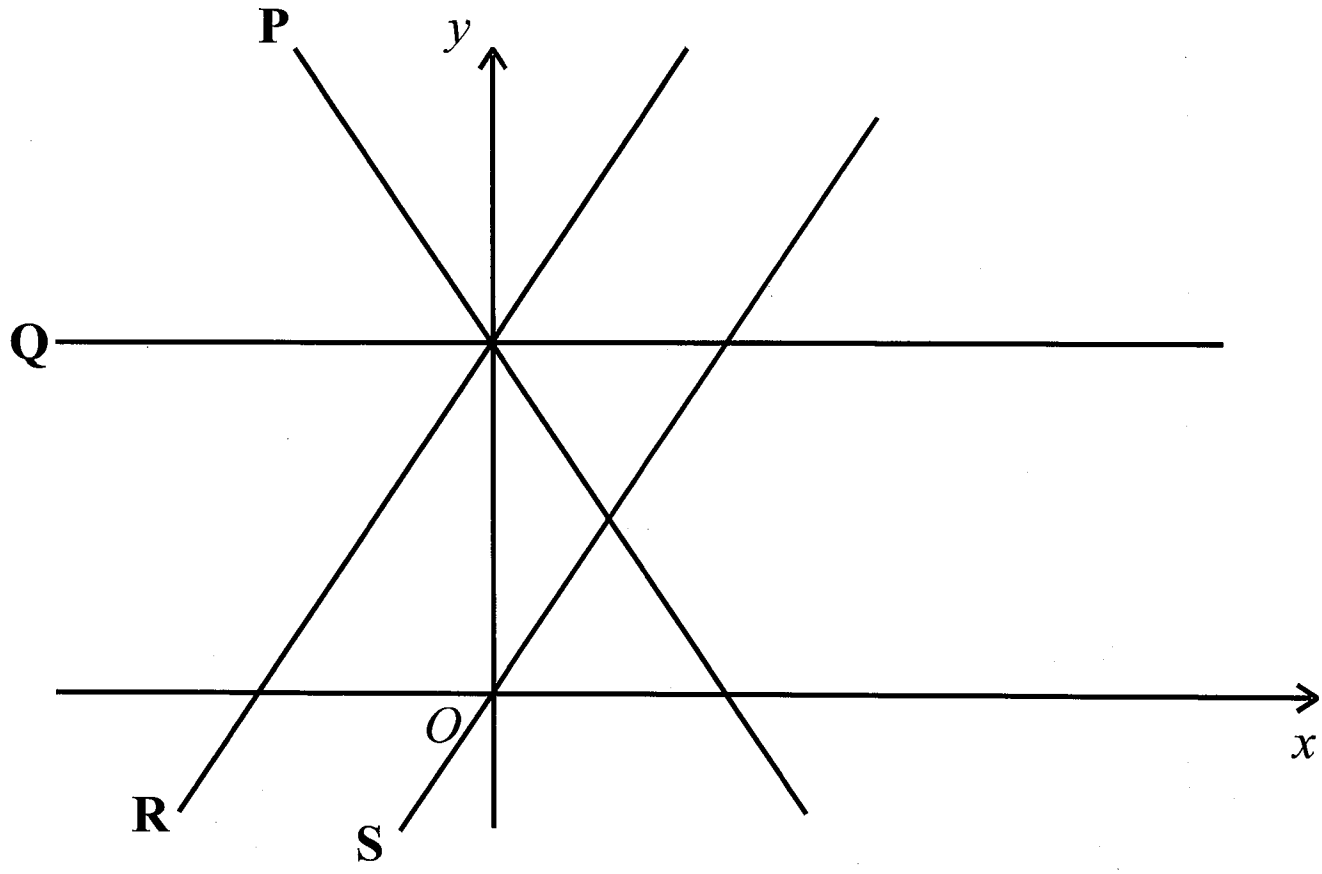


Find the equation of the line that passes through A and B.

$y = 2x + 3$

(Total for Question 12 is 3 marks)

13



The diagram shows 4 straight lines, labelled P, Q, R and S.
The equations of the straight lines are:

A: $y = 2x$
B: $y = 3 - 2x$
C: $y = 2x + 3$
D: $y = 3$

Match each straight line, P, Q, R and S to its equation.
Complete the table.

Equation	A	B	C	D
Straight line	S	P	R	Q

(Total for Question 13 is 2 marks)

Name: _____

GCSE (1 – 9)

The Gradient of a Line

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

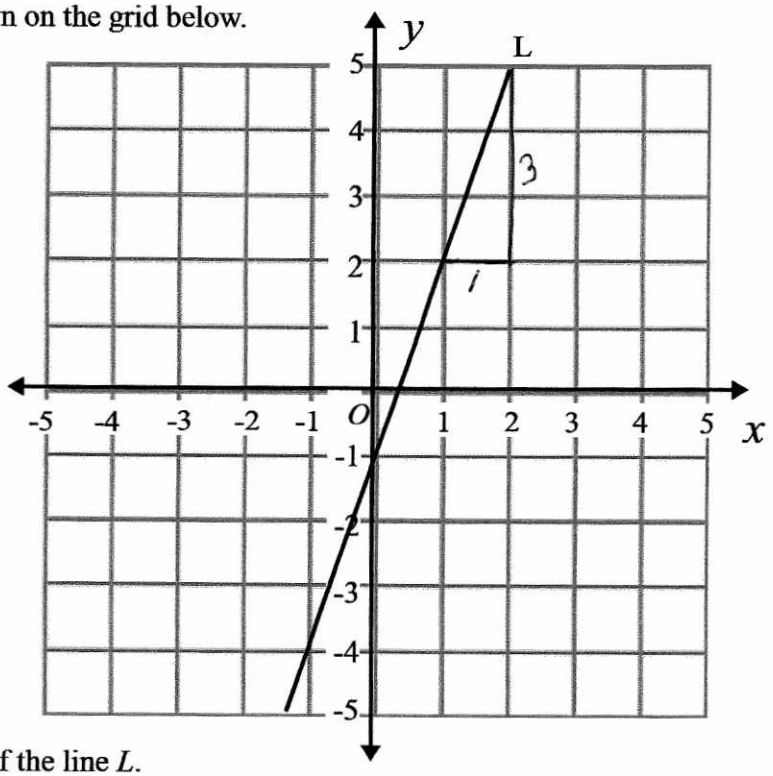
Information

- 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

1 The line L is drawn on the grid below.

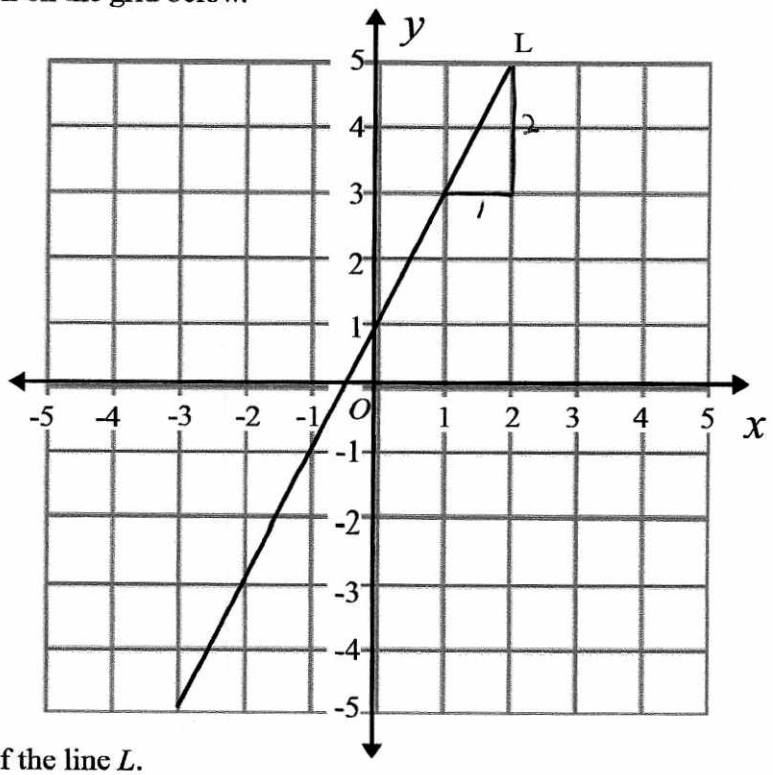


Find the gradient of the line L.

3

(Total for question 1 is 1 mark)

2 The line L is drawn on the grid below.

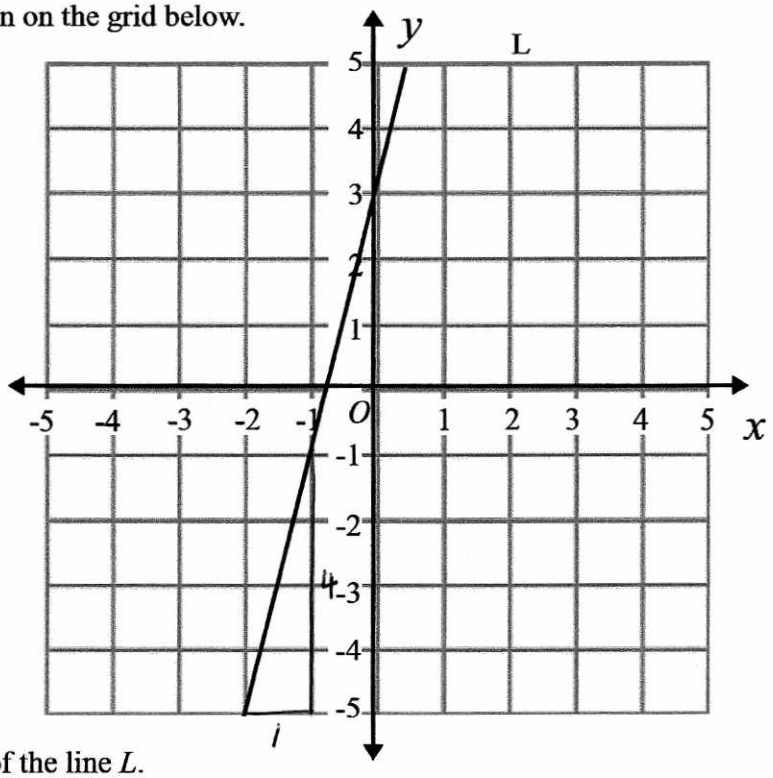


Find the gradient of the line L.

2

(Total for question 2 is 1 mark)

3 The line L is drawn on the grid below.

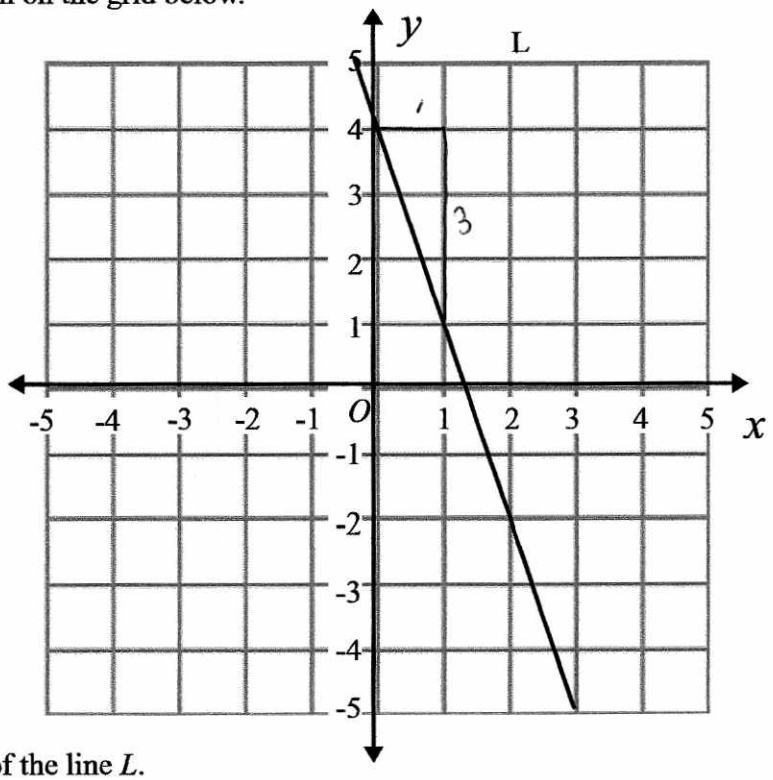


Find the gradient of the line L.

4

(Total for question 3 is 1 mark)

4 The line L is drawn on the grid below.

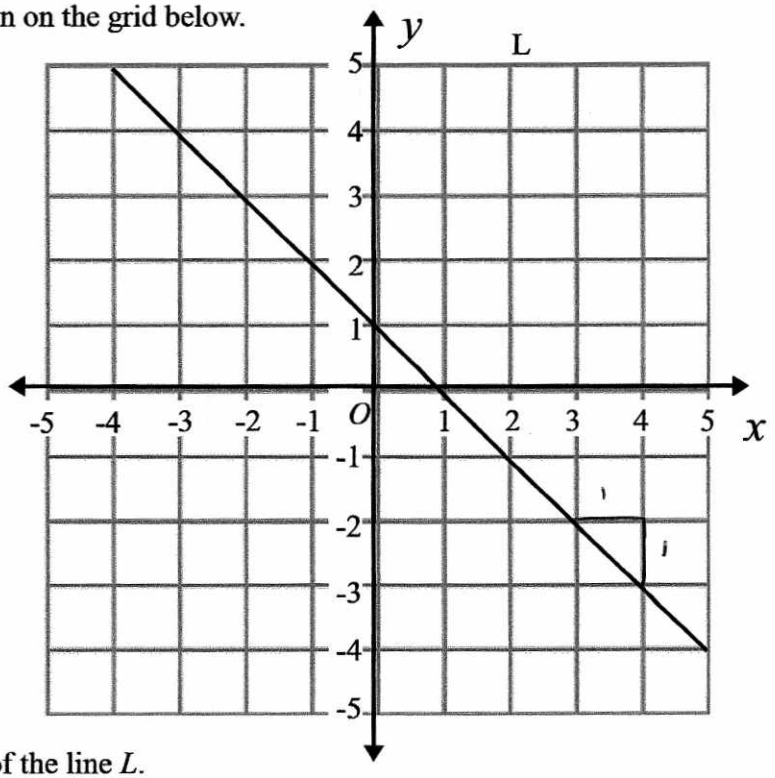


Find the gradient of the line L.

-3

(Total for question 4 is 1 mark)

5 The line L is drawn on the grid below.

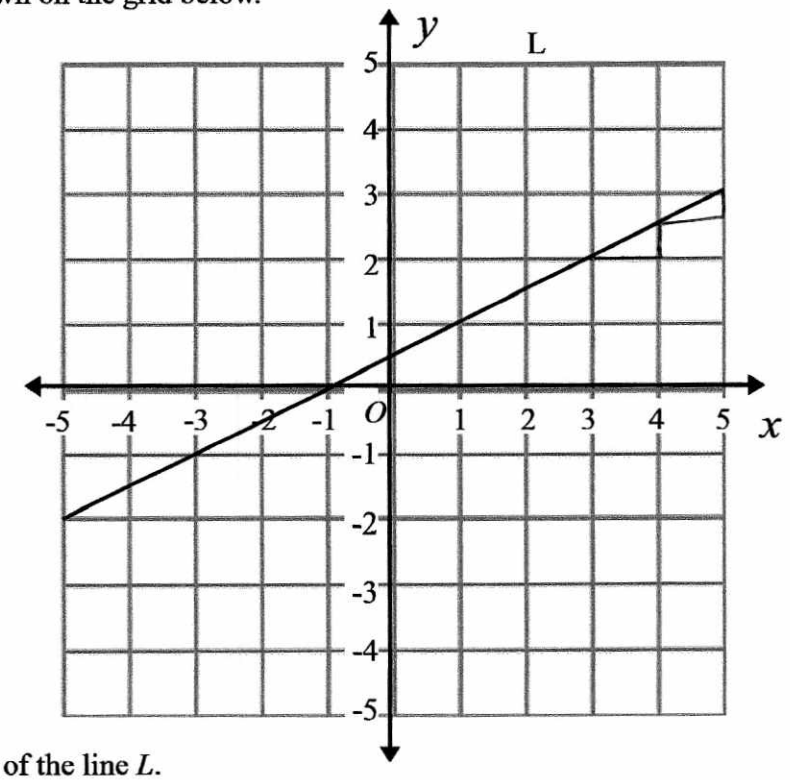


Find the gradient of the line L.

-1

(Total for question 5 is 1 mark)

6 The line L is drawn on the grid below.



Find the gradient of the line L.

$\frac{1}{2}$

(Total for question 6 is 1 mark)

7 Find the gradient of the line that passes through (2, 1) and (5, 10).

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{10 - 1}{5 - 2}$$

$$= \frac{9}{3}$$

3

(Total for question 7 is 2 marks)

8 Find the gradient of the line that passes through (5, 4) and (7, 0).

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{0 - 4}{7 - 5}$$

$$= \frac{-4}{2}$$

$$= -2$$

-2

(Total for question 8 is 2 marks)

9 Find the gradient of the line that passes through (-3, 4) and (5, 8).

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{8 - 4}{5 - -3}$$

$$= \frac{4}{8}$$

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

$\frac{1}{2}$

(Total for question 9 is 2 marks)

10 Find the gradient of the line that passes through (3, 7) and (1, 10).

$x_1\ y_1\ x_2\ y_2$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{10 - 7}{1 - 3}$$

$$= \frac{3}{-2}$$

$$= -1.5$$

-1.5

(Total for question 10 is 2 marks)

---

11 Find the gradient of the line that passes through (1, -1) and (-3, -9).

$x_1\ y_1\ x_2\ y_2$

$$m = \frac{-9 - -1}{-3 - 1}$$

$$= \frac{-8}{-4}$$

$$= 2$$

2

(Total for question 11 is 2 marks)

---

12 Find the gradient of the line that passes through (8, 1) and (3, -3).

$x_1\ y_1\ x_2\ y_2$

$$m = \frac{-3 - 1}{3 - 8}$$

$$= \frac{-4}{-5}$$

$$= \frac{4}{5}$$

$\frac{4}{5}$

(Total for question 12 is 2 marks)

13 Find the gradient of the line that passes through (3, -1) and (-2, 9).

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{9 - -1}{-2 - 3}$$

$$= \frac{10}{-5}$$

$$= -2$$

-2

(Total for question 13 is 2 marks)

14 Find the gradient of the line that passes through (-1, -2) and (-3, 10).

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{10 - -2}{-3 - -1}$$

$$= \frac{12}{-2}$$

$$= -6$$

-6

(Total for question 14 is 2 marks)

15 Find the gradient of the line that passes through (-3, 4) and (-5, 7).

$x_1\ y_1\ \ x_2\ y_2$

$$m = \frac{7 - 4}{-5 - -3}$$

$$= \frac{3}{-2}$$

$$= -1.5$$

-1.5

(Total for question 15 is 2 marks)

16 The line AB passes through the points A(2, -1) and $(6, k)$.

The gradient of AB is 5.

Work out the value of k.

$x_1\ y_1\ x_2\ y_2$

$$5 = \frac{k - -1}{6 - 2}$$

$$5 = \frac{k + 1}{4}$$

$$20 = k + 1$$

$$k = 19$$

$k =$ 19

(Total for question 16 is 3 marks)

---

17 The line AB passes through the points A(-3, 4) and $(k, 12)$.

The gradient of AB is 4.

Work out the value of k.

$x_1\ y_2\ x_2\ y_2$

$$4 = \frac{12 - 4}{k - -3}$$

$$4 = \frac{8}{k + 3}$$

$$4(k + 3) = 8$$

$$k + 3 = 2$$

$$k = -1$$

$k =$ −1

(Total for question 17 is 3 marks)

---

18 The line AB passes through the points A(-2, k) and (4, 8).

The gradient of AB is -2.

Work out the value of k.

$x_1\ y_1\ x_2\ y_2$

$$-2 = \frac{8 - k}{4 - -2}$$

$$-2 = \frac{8 - k}{6}$$

$$-12 = 8 - k$$

$$-12 + k = 8$$

$$k = 20$$

$k =$ 20

(Total for question 18 is 3 marks)

Name: _____

GCSE (1 – 9)

Solving Simultaneous Equations Graphically

Instructions

- Use **black** ink or ball-point pen.
- Answer all Questions.
- Answer the Questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

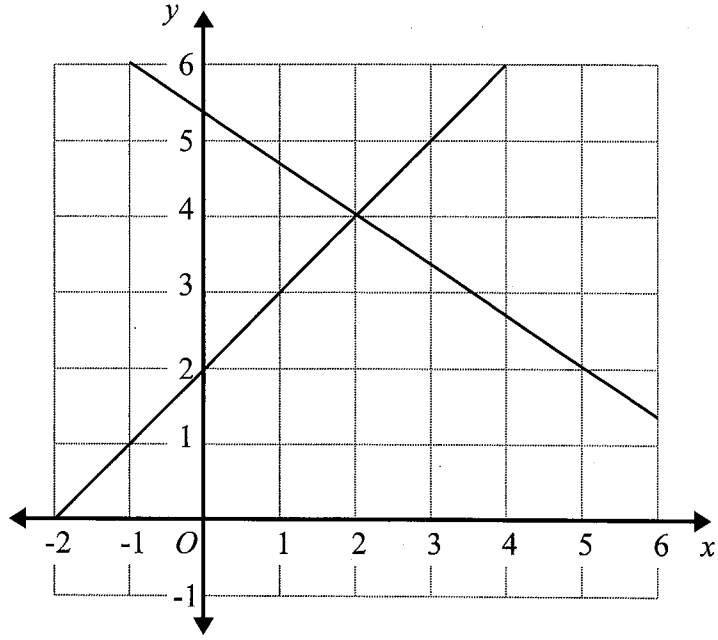
Information

- 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

1 The graphs of the straight lines with equations $y = x + 2$ and $2x + 3y = 16$ have been drawn on the grid.



Use the graphs to solve the simultaneous equations

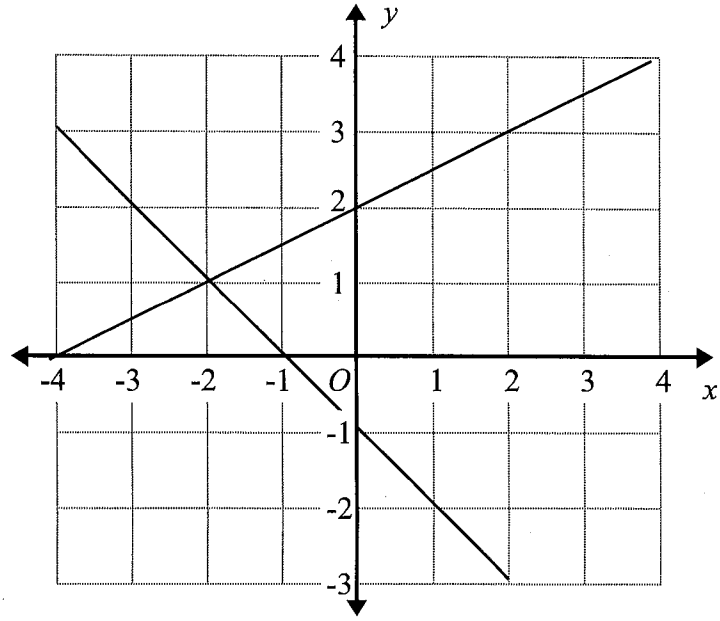
$y = x + 2$
$2x + 3y = 16$

$x = 2, \quad y = 4$

(Total for Question 1 is 2 marks)

---

2 The graphs of the straight lines with equations $2y - x = 4$ and $x + y = -1$ have been drawn on the grid.



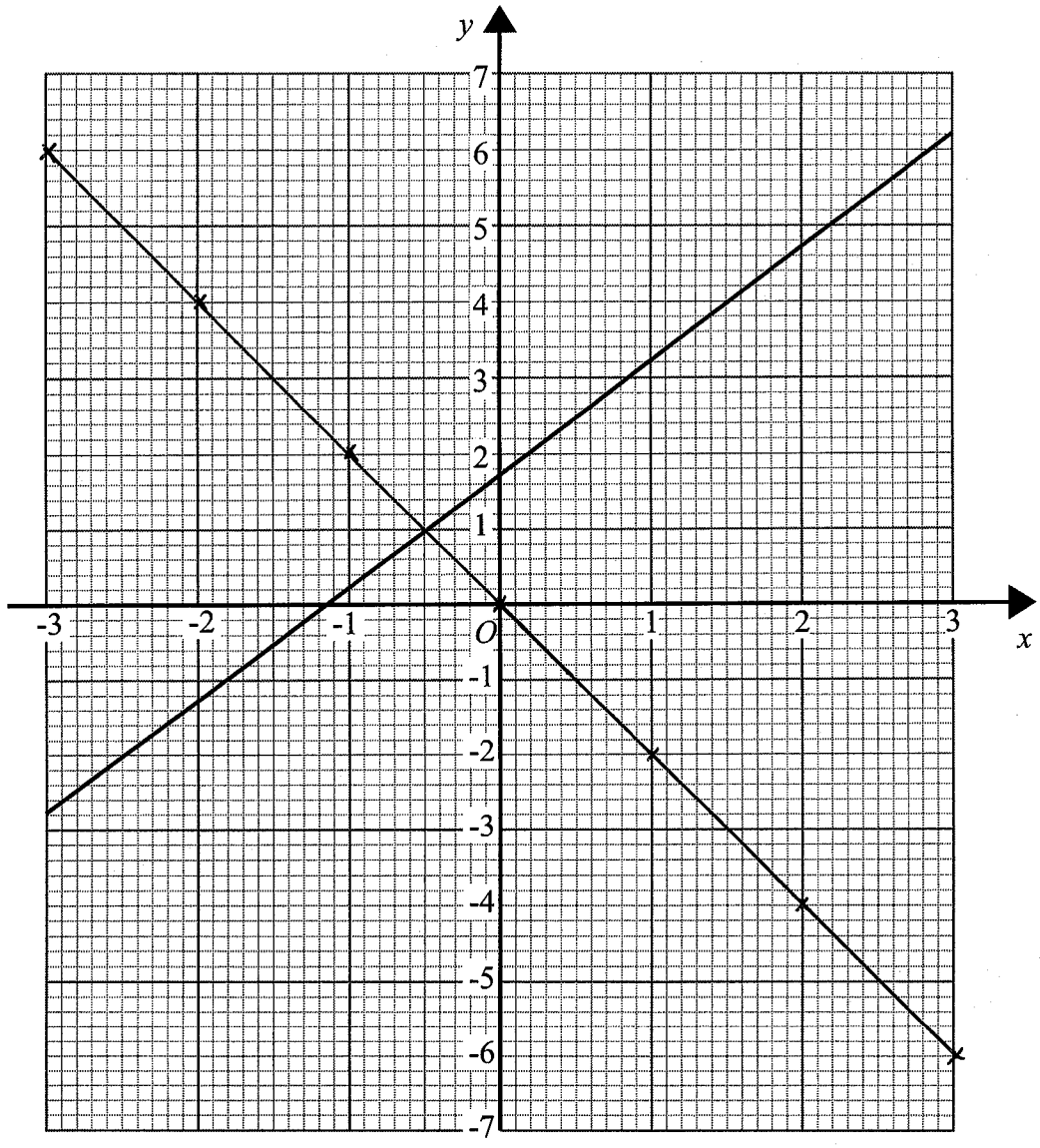
Use the graphs to solve the simultaneous equations

$2y - x = 4$
$x + y = -1$

$x = -2, \quad y = 1$

(Total for Question 2 is 2 marks)

3 The graph of $4y - 6x = 7$ is drawn on the grid.



(a) On the grid , draw the graph of $y = -2x$ **(2)**

x	-3	-2	-1	0	1	2	3
y	6	4	2	0	-2	-4	-6

(b) Use the graphs to solve the simultaneous equations

$4y - 6x = 7$
$y = -2x$

$x =$ −0.5

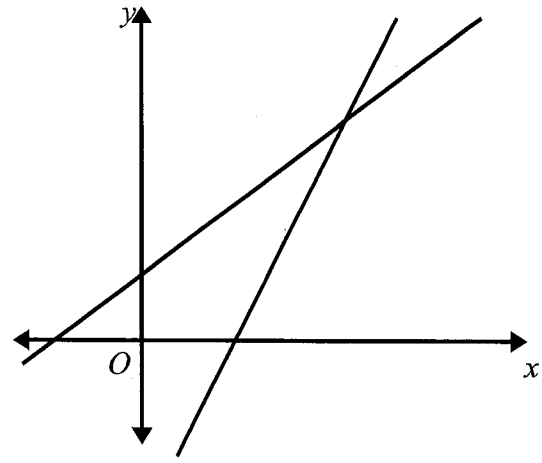
$y =$ 1

(2)

(Total for Question 3 is 4 marks)

4 The diagram shows two straight lines.
The equation of the lines are $y = 4x - 5$ and $y = 2x + 1$

Work out the coordinates of the point where the line intersect.



$y = 4x - 5$

$y = 2x + 1$

$4x - 5 = 2x + 1$

$-2x \qquad -2x$

$2x - 5 = 1$

$+5 \qquad +5$

$2x = 6$

$x = 3$

$y = 2(3) + 1$

$= 6 + 1$

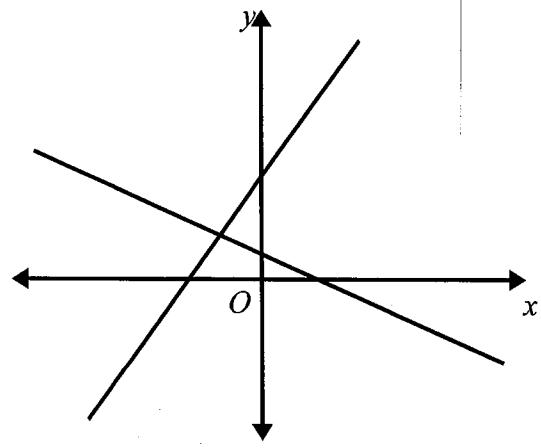
$= 7$

(3, 7)

(Total for Question 4 is 3 marks)

5 The diagram shows two straight lines.
The equation of the lines are $y = 2x + 3$ and $y = -\frac{2}{3}x + 1$

Work out the coordinates of the point where the line intersect.



$y = 2x + 3$

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

$2x + 3 = -\frac{2}{3}x + 1$

$6x + 9 = -2x + 3$

$+2x \qquad +2x$

$8x + 9 = 3$

$-9 \qquad -9$

$8x = -6$

$x = \frac{-6}{8} = -\frac{3}{4} = -0.75$

$y = 2\left(-\frac{3}{4}\right) + 3$

$= -\frac{6}{4} + 3$

$= -1.5 + 3$

$= 1.5$

(−0.75, 1.5)

(Total for Question 5 is 3 marks)

Name: _____

GCSE (1 – 9)

Simultaneous Equations

Instructions

- Use **black** ink or ball-point pen.
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- Answer the Questions in the spaces provided
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- You must **show all your working out.**

Information

- 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

1 Solve the simultaneous equations

$$4x + 3y = 18$$
$$x - 3y = 7$$

$5x = 25$

$x = 5$

$4(5) + 3y = 18$

$20 + 3y = 18$

$3y = -2$

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

$x =$ 5

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

(Total for question 1 is 3 marks)

---

2 Solve the simultaneous equations

$$x - 3y = -23 \quad \times 5$$
$$5x + 2y = 4$$

$5x - 15y = -115$

$5x + 2y = 4$

$-17y = -119$

$y = \frac{119}{17}$

$= 7$

$5x + 2(7) = 4$

$5x + 14 = 4$

$5x = -10$

$x = -2$

$x =$ -2

$y =$ 7

(Total for question 2 is 3 marks)

3 Solve the simultaneous equations

$$2x + 5y = -10$$
$$2x - y = 8$$

$$6y = -18$$
$$y = -3$$

$$2x + 5(-3) = -10$$
$$2x - 15 = -10$$
$$2x = 5$$
$$x = \frac{5}{2}$$

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

$y =$ -3

(Total for question 3 is 3 marks)

---

4 Solve the simultaneous equations

$$4x + 2y = 10 \quad \times 5$$
$$5x + 3y = 12 \quad \times 4$$

$$20x + 10y = 50$$
$$20x + 12y = 48$$
$$-2y = 2$$
$$y = -1$$

$$4x + 2(-1) = 10$$
$$4x - 2 = 10$$
$$4x = 12$$
$$x = 3$$

$x =$ 3

$y =$ -1

(Total for question 4 is 3 marks)

5 Solve the simultaneous equations

$2x + 5y = 4$
$7x - 5y = -1$

$9x = 3$

$x = \frac{3}{9} = \frac{1}{3}$

$2\left(\frac{1}{3}\right) + 5y = 4$

$\frac{2}{3} + 5y = 4$

$\frac{2}{3} + 5y = \frac{12}{3}$

$5y = \frac{10}{3}$

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

$x = \frac{1}{3}$

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

(Total for question 5 is 3 marks)

---

6 Solve the simultaneous equations

$3x - 2y = 7$
$7x + 2y = 13$

$10x = 20$

$x = 2$

$7(2) + 2y = 13$

$14 + 2y = 13$

$2y = -1$

$y = -\frac{1}{2}$

$x = 2 \quad y = -\frac{1}{2}$

(Total for question 6 is 3 marks)

7 Solve the simultaneous equations

$2x - 3y = 4$ $\quad \times 2$

$4x - y = 13$

$4x - 6y = 8$

$4x - y = 13$

$-5y = -5$

$y = 1$

$4x - 1 = 13$

$4x = 14$

$x = \frac{14}{4} = \frac{7}{2}$

$x =$ $\frac{7}{2}$

$y =$ 1

(Total for question 8 is 3 marks)

8 Solve the simultaneous equations

$3x + y = 15$ $\quad \times 2$

$5x + 2y = 24$

$6x + 2y = 30$

$5x + 2y = 24$

$x = 6$

$3(6) + y = 15$

$18 + y = 15$

$y = -3$

$x = 6 \quad y = -3$

(Total for question 8 is 3 marks)

9 Solve the simultaneous equations

$$3x - y = -4 \quad \times 2$$
$$2x - 3y = 9 \quad \times 3$$

$$6x - 2y = -8$$
$$6x - 9y = 27$$

$$7y = -35$$
$$y = -5$$

$$3x - (-5) = -4$$
$$3x + 5 = -4$$
$$3x = -9$$
$$x = -3$$

$x =$ -3

$y =$ -5

(Total for question 9 is 3 marks)

10 Solve the simultaneous equations

$$6x + 5y = 4.5$$
$$3x - 2y = 9 \quad \times 2$$

$$6x - 4y = 18$$
$$6x + 5y = 4.5$$

$$-9y = 13.5$$
$$y = -\frac{13.5}{9} = \frac{-27}{18} = -\frac{3}{2}$$

$$3x - 2\left(\frac{-3}{2}\right) = 9$$

$$3x + 3 = 9$$
$$3x = 6$$
$$x = 2$$

$x =$ 2

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

(Total for question 10 is 3 marks)

11 Solve the simultaneous equations

$$3x = 9 + y$$
$$x + 5y = 5$$

$3x - y = 9$

$x + 5y = 5 \quad \times 3$

$3x - y = 9$

$3x + 15y = 15$

$-16y = -6$

$y = \frac{6}{16} = \frac{3}{8}$

$x + 5\left(\frac{3}{8}\right) = 5$

$x + \frac{15}{8} = 5$

$x = \frac{40}{8} - \frac{15}{8} = \frac{25}{8}$

$x = \frac{25}{8}$

$y = \frac{3}{8}$

(Total for question 11 is 3 marks)

12 Solve the simultaneous equations

$$3y + 11 = 4x$$
$$10x + 2y + 1 = 0$$

~~3y~~ $11 = 4x - 3y$

$4x - 3y = 11 \quad (1) \quad \times 5$

$10x + 2y = -1 \quad (2) \quad \times 2$

$20x - 15y = 55$

$20x + 4y = -2$

$-19y = 57$

$y = -3$

$4x - 3(-3) = 11$

$4x + 9 = 11$

$4x = 2$

$x = \frac{1}{2}$

$x = \frac{1}{2}$

$y = -3$

(Total for question 12 is 3 marks)

13 In a shop 2 coffees and 3 cakes cost £9.95
In the same shop 1 coffee and 4 cakes cost £10.35.
Work out the price for one coffee and the price for one cake.

$2x + 3y = 9.95$

$x + 4y = 10.35 \quad \times 2$

$2x + 8y = 20.70$

$2x + 3y = 9.95$

$5y = 10.75$

$y = 2.15$

$x + 4(2.15) = 10.35$

$x + 8.60 = 10.35$

$x = 1.75$

Coffee £ 1.75

Cake £ 2.15

(Total for question 13 is 3 marks)

---

14 Sweets are sold in small packs and in big packs.
There is a total of 175 sweets in 4 small packs and 3 big packs.
There is a total of 154 sweets in 5 small packs and 2 big packs.
Work out the number of sweets in each small pack and in each big pack.

$4s + 3b = 175 \quad \times 2$

$5s + 2b = 154 \quad \times 3$

$8s + 6b = 350$

$15s + 6b = 462$

$-7s = -112$

$s = 16$

$5(16) + 2b = 154$

$80 + 2b = 154$

$2b = 74$

$b = 37$

Small Pack 16

Big Pack 37

(Total for question 14 is 3 marks)

Name: _____

GCSE (1 – 9)

Cubic and Reciprocal Graphs

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

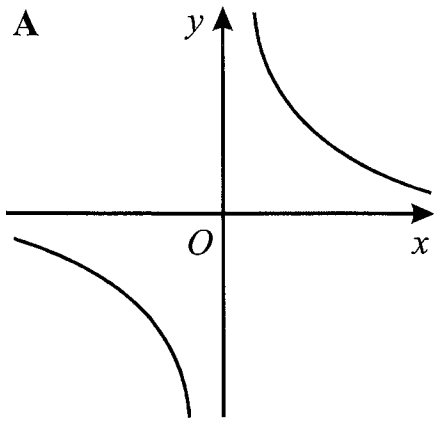
- The marks for each question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

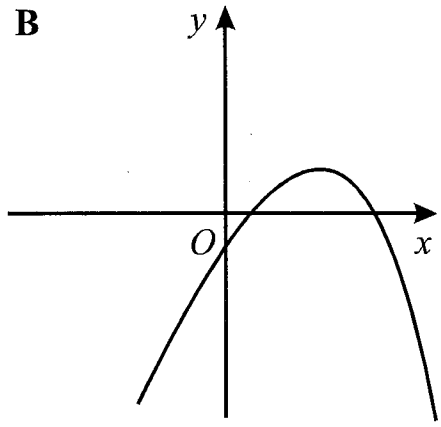
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

1 Here are nine graphs.

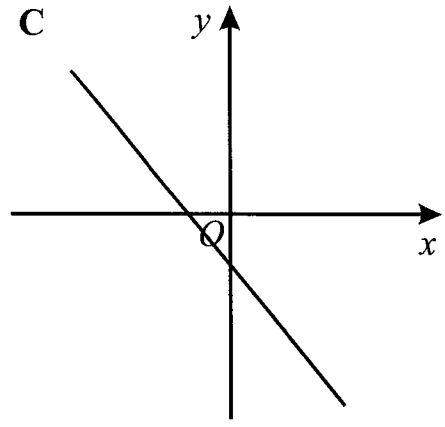
A



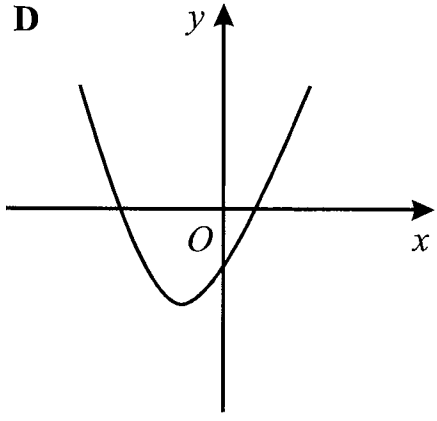
B



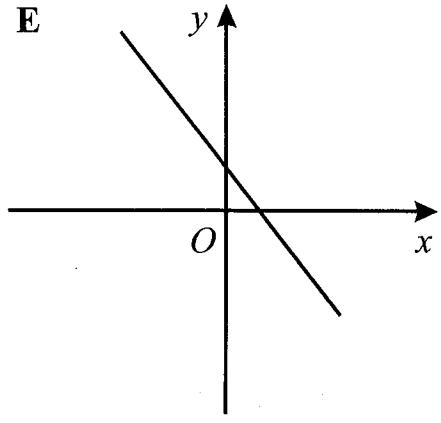
C



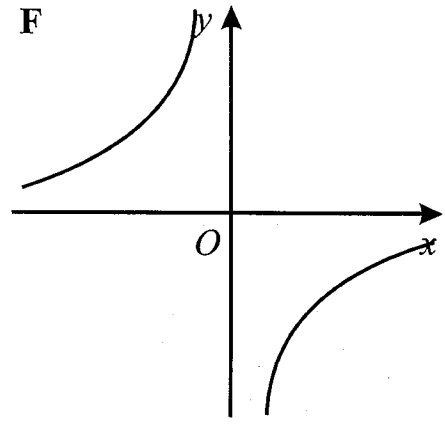
D



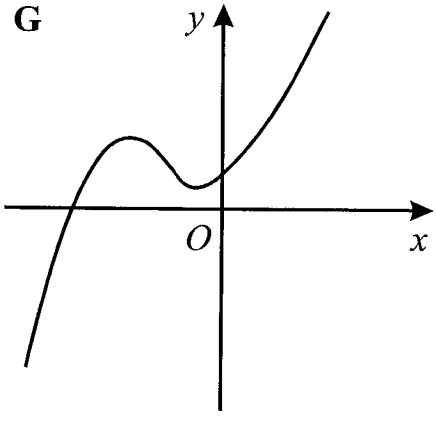
E



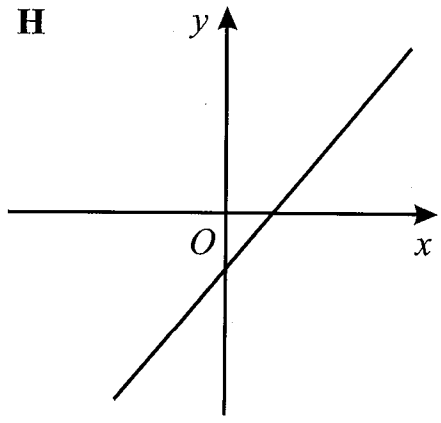
F



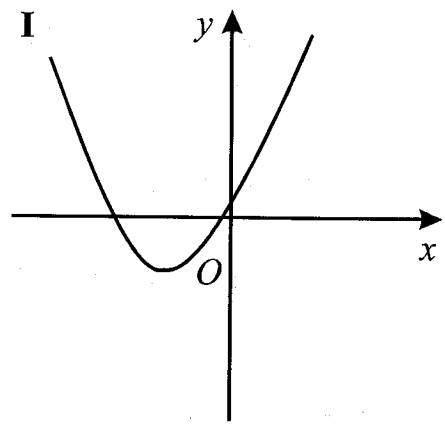
G



H



I



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

(i) $y = 3x - 2$

H

(1)

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

D

(1)

(iii) $y = \frac{3}{x}$

A

(1)

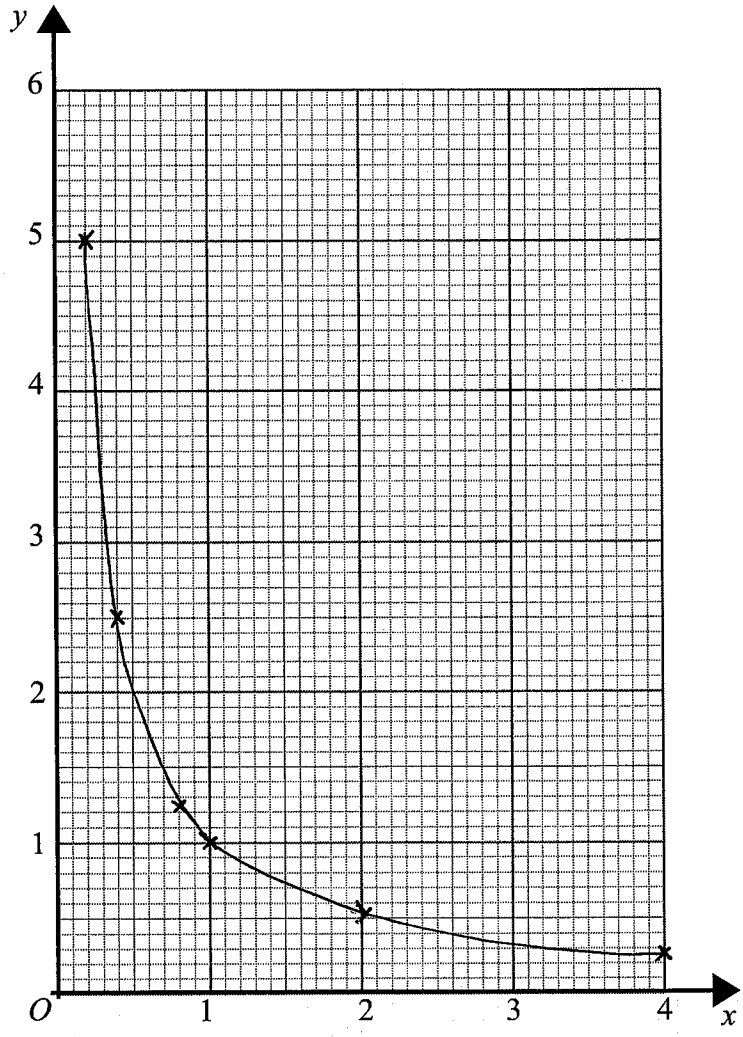
(Total for Question 1 is 3 marks)

2 (a) Complete the table of values for $y=\frac{1}{x}$

x	0.2	0.4	0.8	1	2	4
y	5	2.5	1.25	1	0.5	0.25

(2)

(b) On the grid, draw the graph of $y=\frac{1}{x}$



(2)

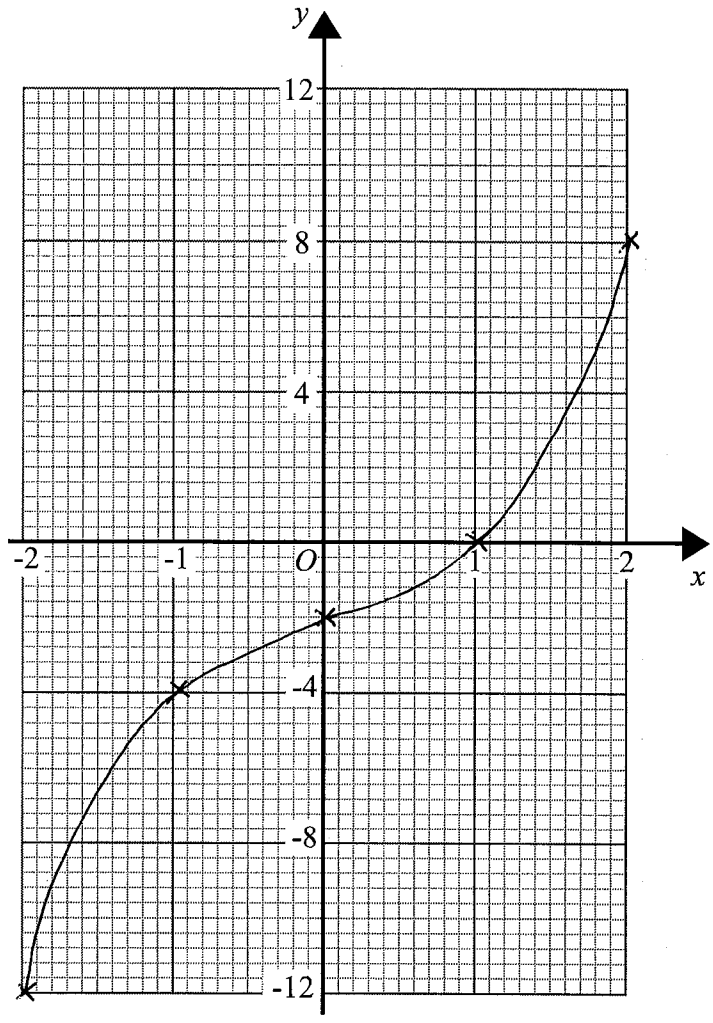
(Total for Question 2 is 4 marks)

3 (a) Complete the table of values for $y = x^3 + x - 2$

x	-2	-1	0	1	2
y	-12	-4	-2	0	8

(2)

(b) On the grid, draw the graph of $y = x^3 + x - 2$



(2)

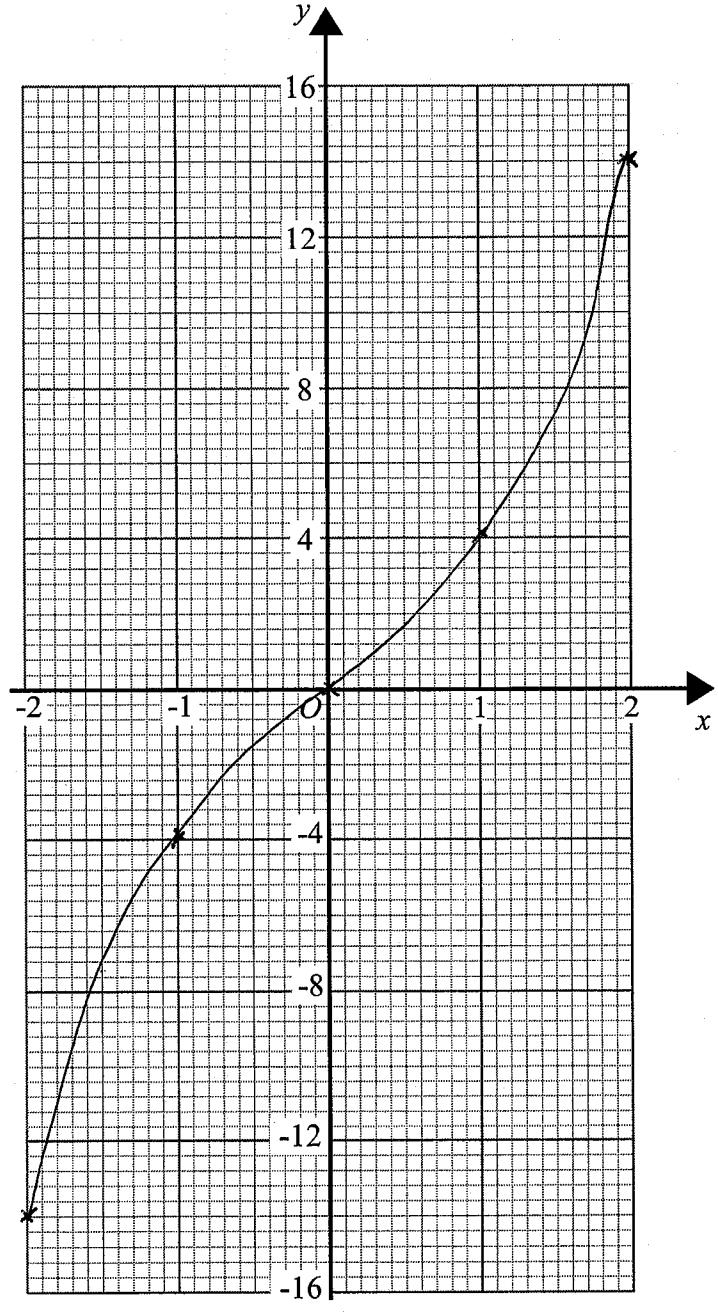
(Total for Question 3 is 4 marks)

4 (a) Complete the table of values for $y = x^3 + 3x$

x	-2	-1	0	1	2
y	-14	-4	0	4	14

(2)

(b) On the grid, draw the graph of $y = x^3 + 3x$



(2)

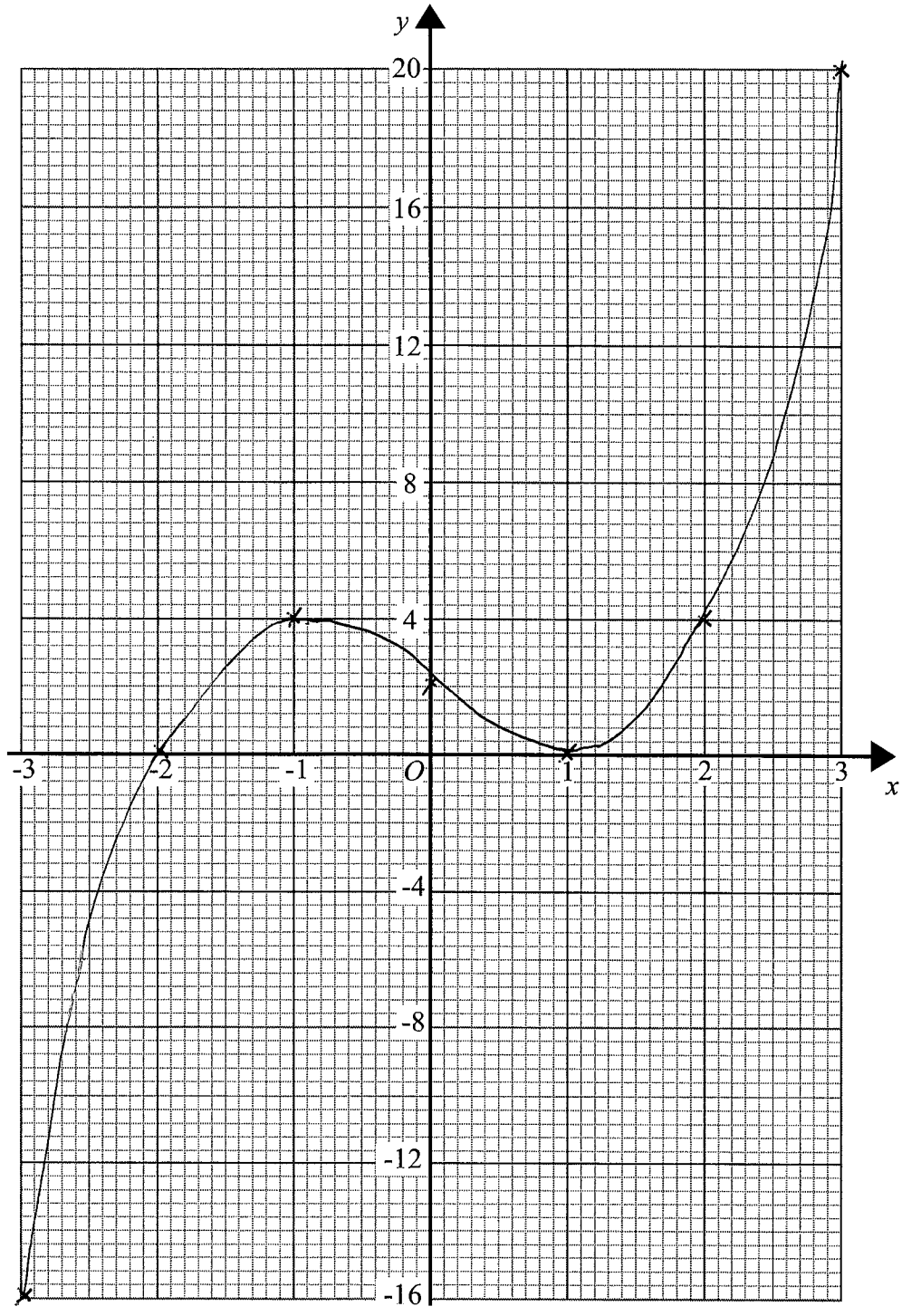
(Total for Question 4 is 4 marks)

5 (a) Complete the table of values for $y = x^3 - 3x + 2$

x	-3	-2	-1	0	1	2	3
y	-16	0	4	2	0	4	20

(2)

(b) On the grid, draw the graph of $y = x^3 - 3x + 2$



(2)

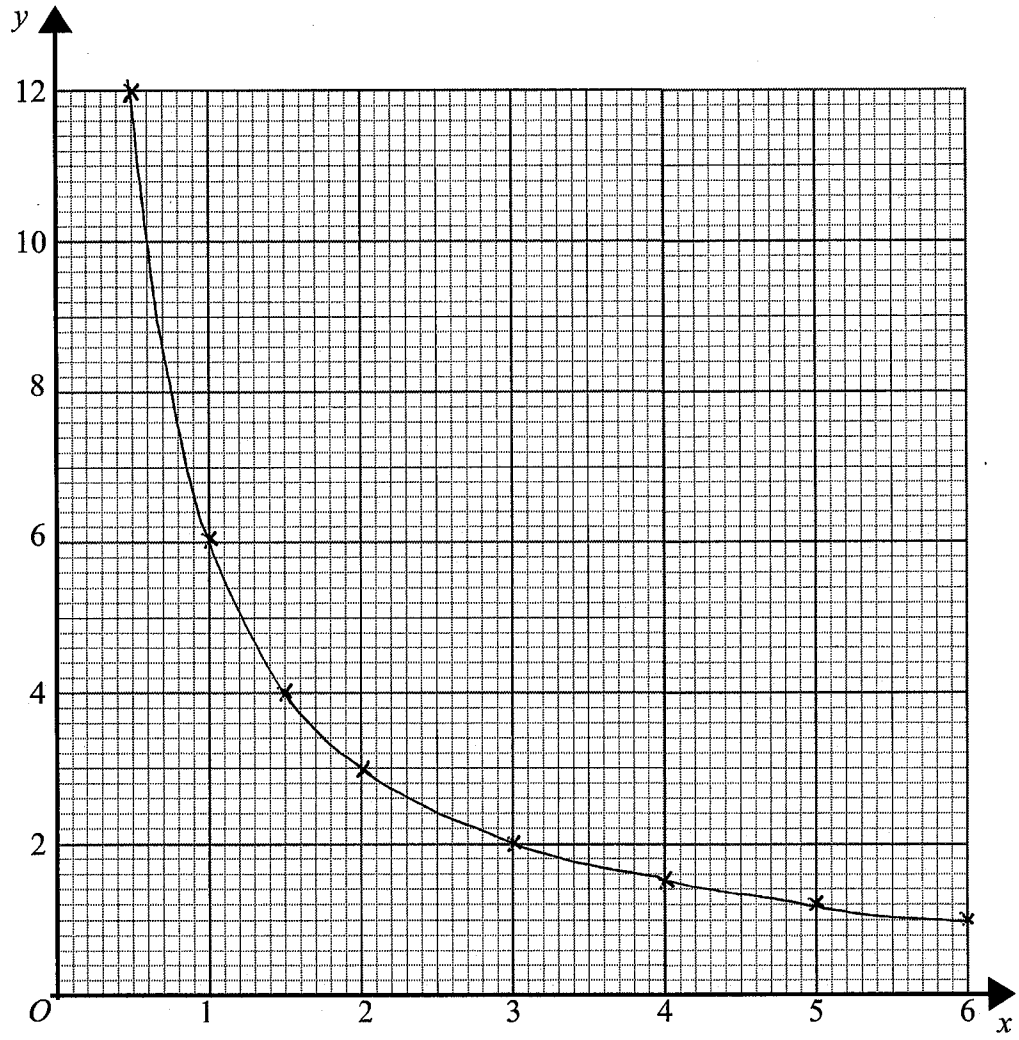
(Total for Question 5 is 4 marks)

6 (a) Complete the table of values for $y=\frac{6}{x}$

x	0.5	1	1.5	2	3	4	5	6
y	12	6	4	3	2	1.5	1.2	1

(2)

(b) On the grid, draw the graph of $y=\frac{6}{x}$



(2)

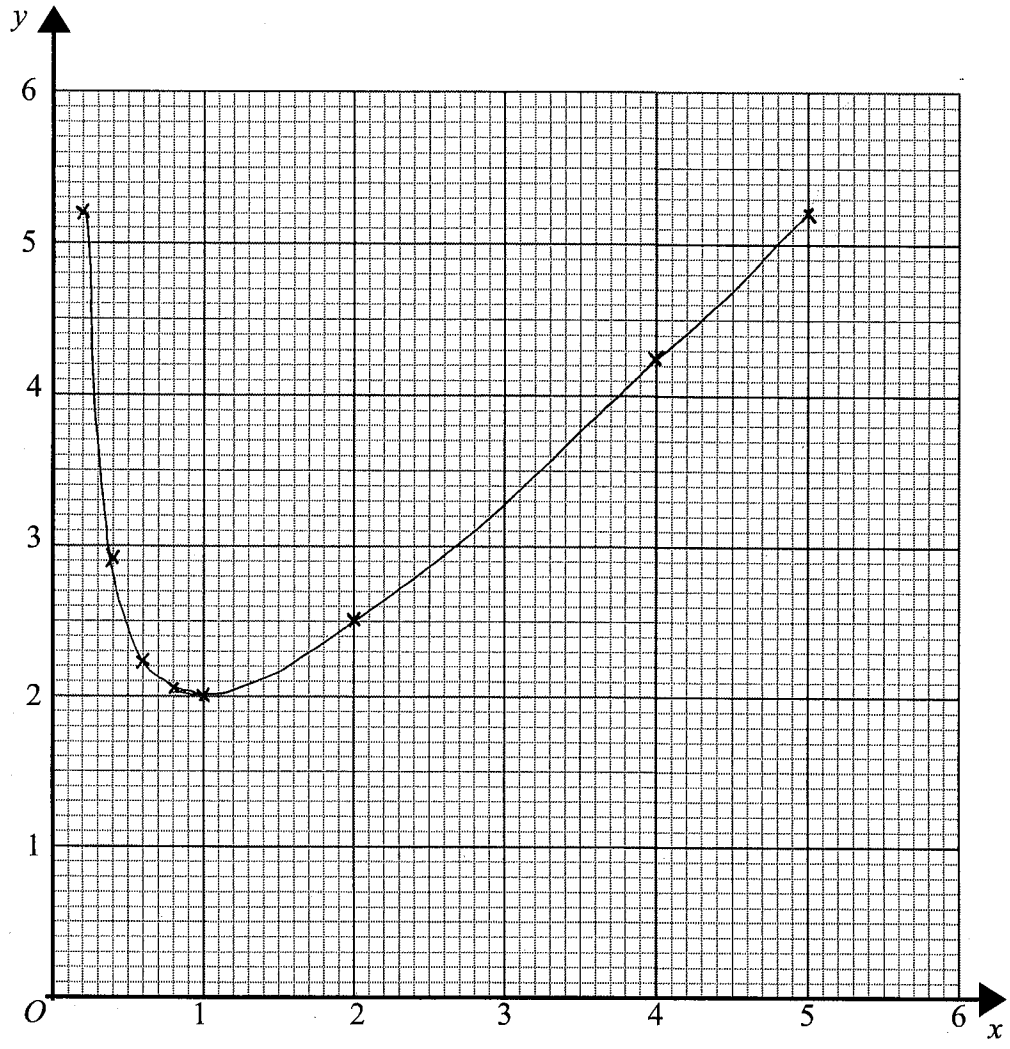
(Total for Question 6 is 4 marks)

7 (a) Complete the table of values for $y = x + \frac{1}{x}$

x	0.2	0.4	0.6	0.8	1	2	4	5
y	5.2	2.9	2.27 (2dp)	2.05	2	2.5	4.25	5.2

(2)

(b) On the grid, draw the graph of $y = x + \frac{1}{x}$



(2)

(Total for Question 7 is 4 marks)

Name: _____

GCSE (1 – 9)

Quadratic Graphs

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

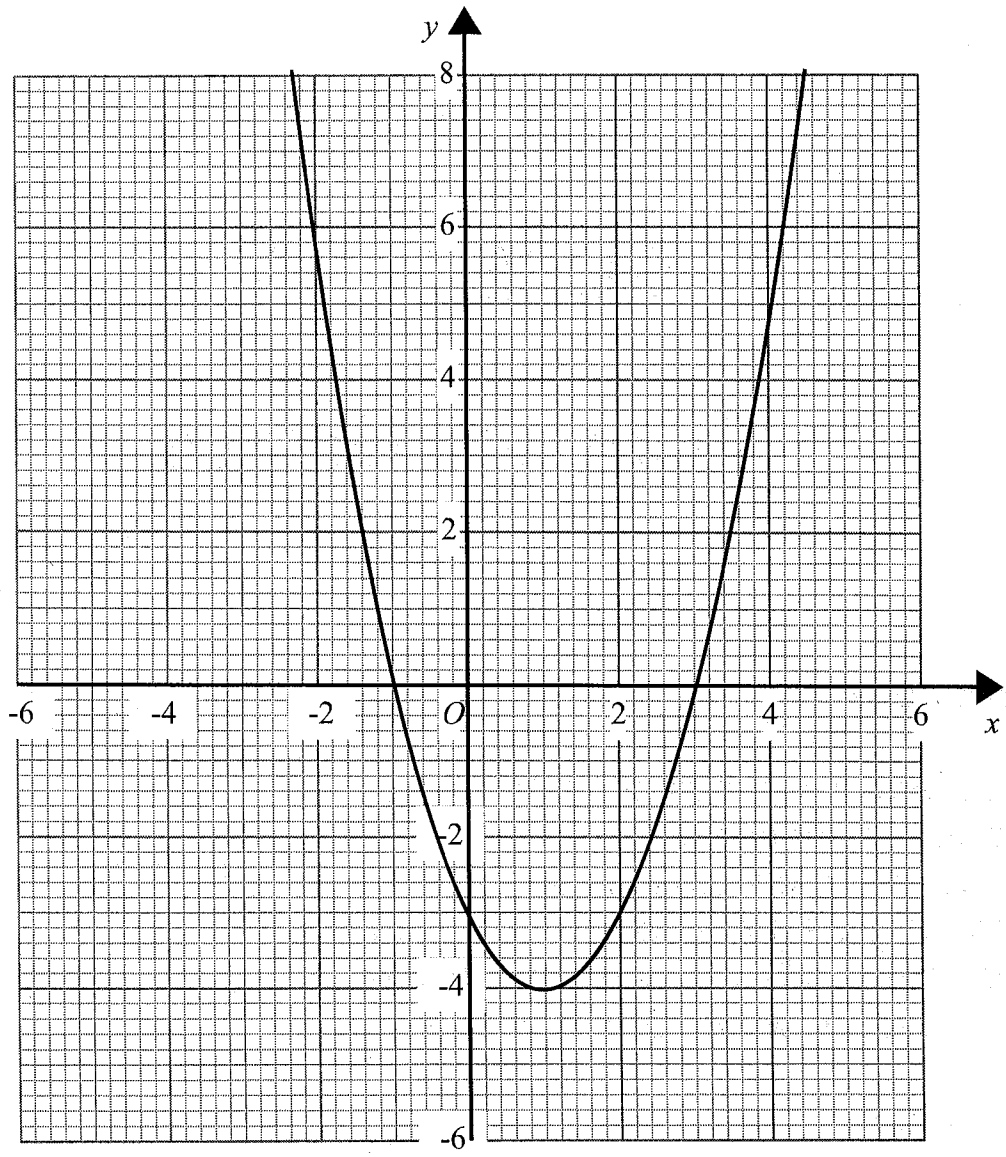
Information

- 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

1 Here is the graph of $y = x^2 - 2x - 3$



(a) Write down the turning point of the graph $y = x^2 - 2x - 3$

(1, −4)

(1)

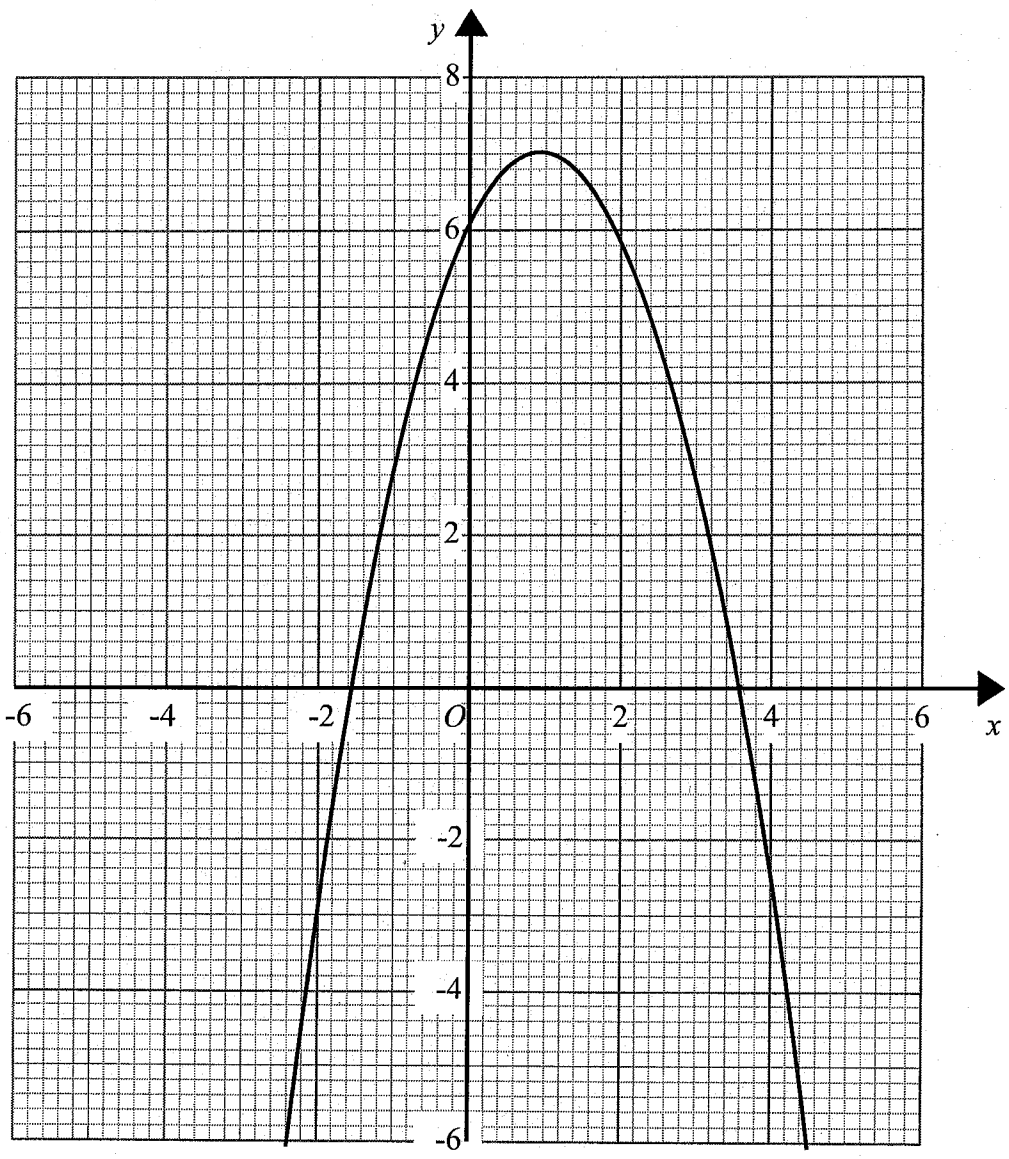
(b) Use the graph to find the roots of the equation $x^2 - 2x - 3 = 0$

−1 and 3

(2)

(Total for question 1 is 3 marks)

2 Here is the graph of $y = 2x + 6 - x^2$



(a) Write down the turning point of the graph $y = 2x + 6 - x^2$

(1, 7)

(1)

(b) Use the graph to find the roots of the equation $x^2 = 2x + 6$

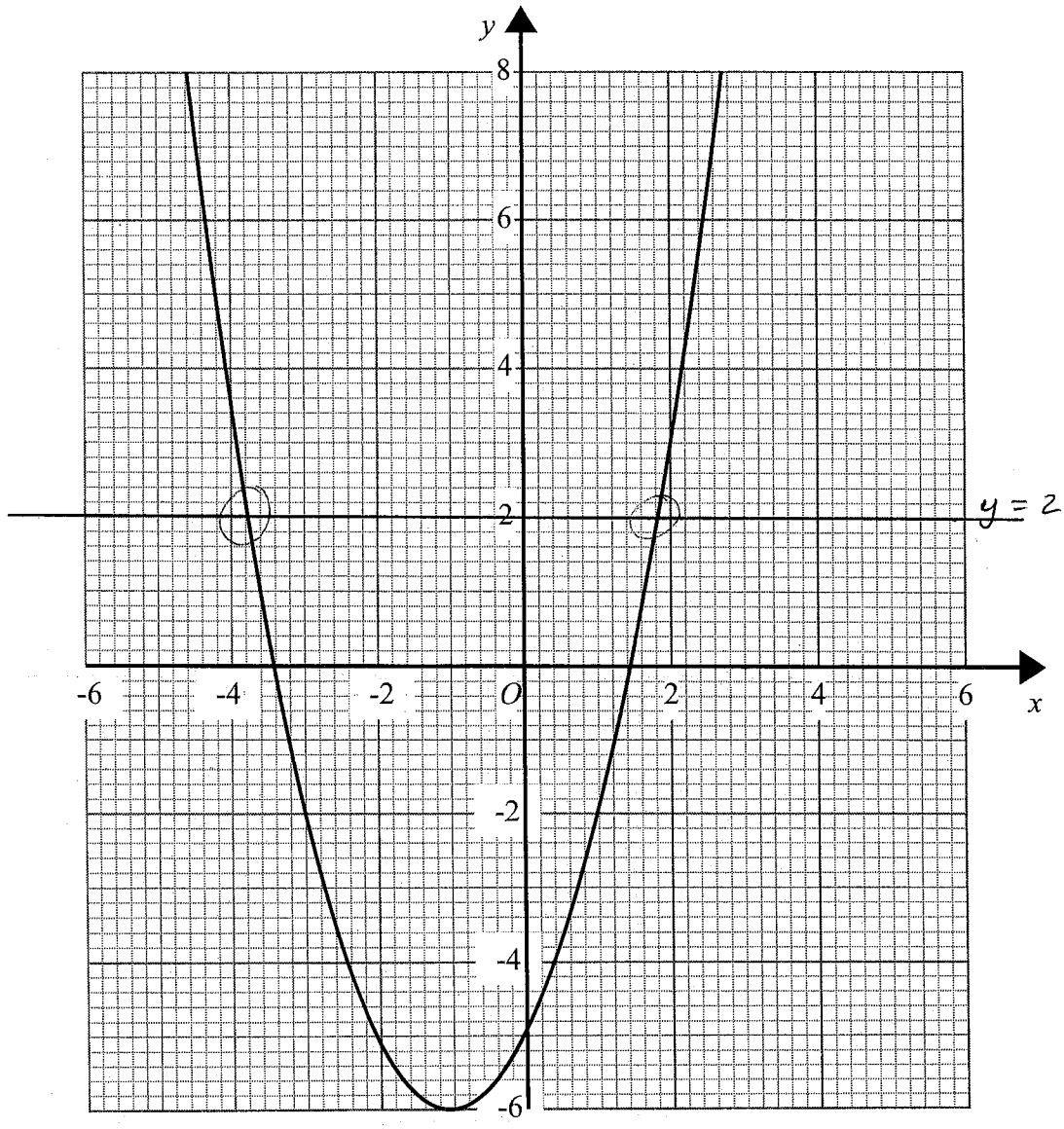
-1.6 and 3.6

(2)

(Total for question 2 is 3 marks)

accept -1.6 to -1.5
3.5 to 3.6

3 Here is the graph of $y = x^2 + 2x - 5$



(a) Write down the turning point of the graph $y = x^2 + 2x - 5$

(−1 , −6)

(1)

(b) Use the graph to find the roots of the equation $x^2 + 2x - 5 = 2$

−3.8 and 1.8

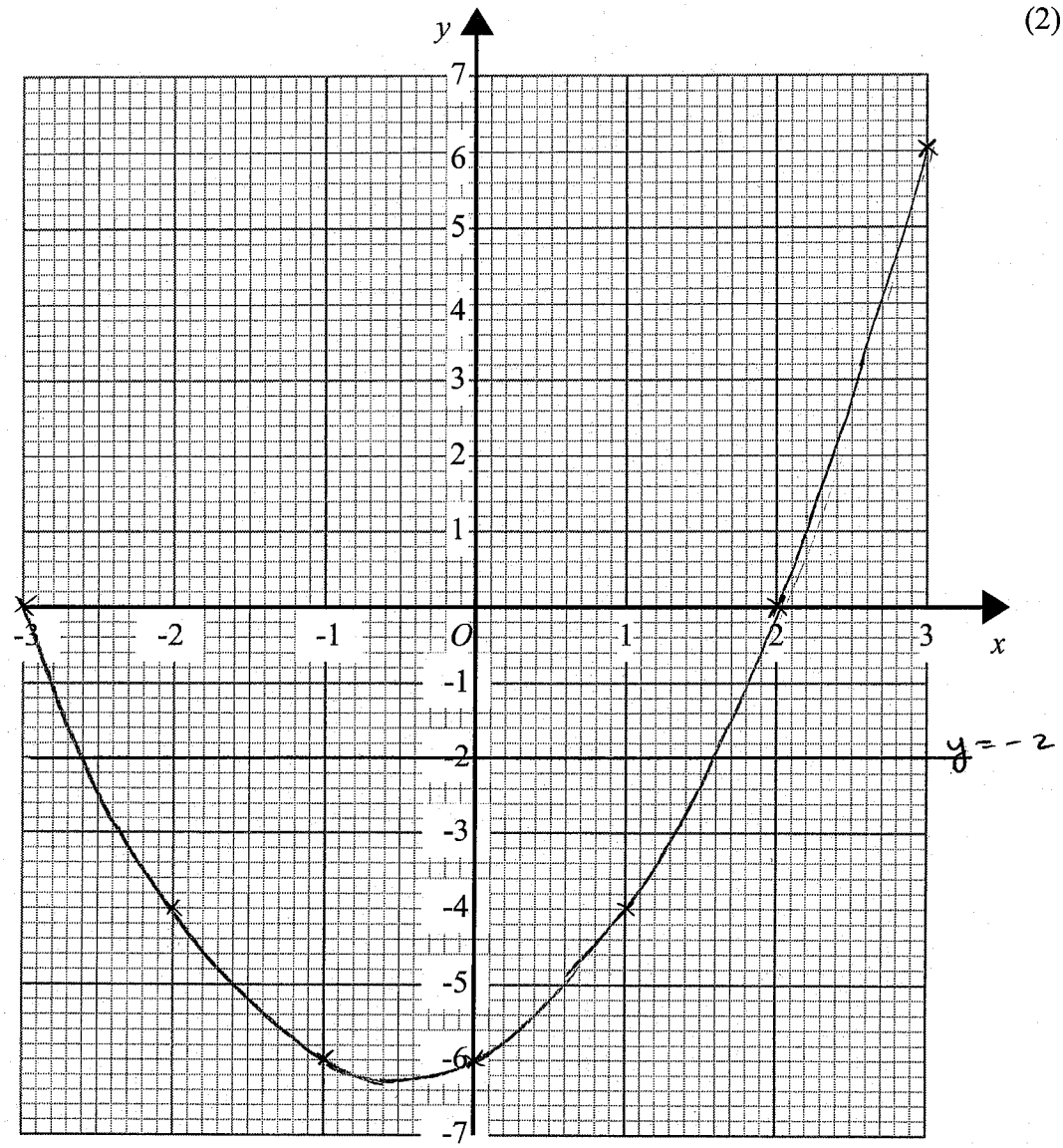
(2)

(Total for question 3 is 3 marks)

4 Complete the table of values for $y = x^2 + x - 6$

x	-3	-2	-1	0	1	2	3
y	0	-4	-6	-6	-4	0	6

(2)



(a) On the grid draw the graph of $y = x^2 + x - 6$ for values of x from –3 to 3 (2)

(b) Use the graph to find estimates of the solutions to the equation $x^2 + x - 6 = -2$

-2.6 and 1.6

(2)

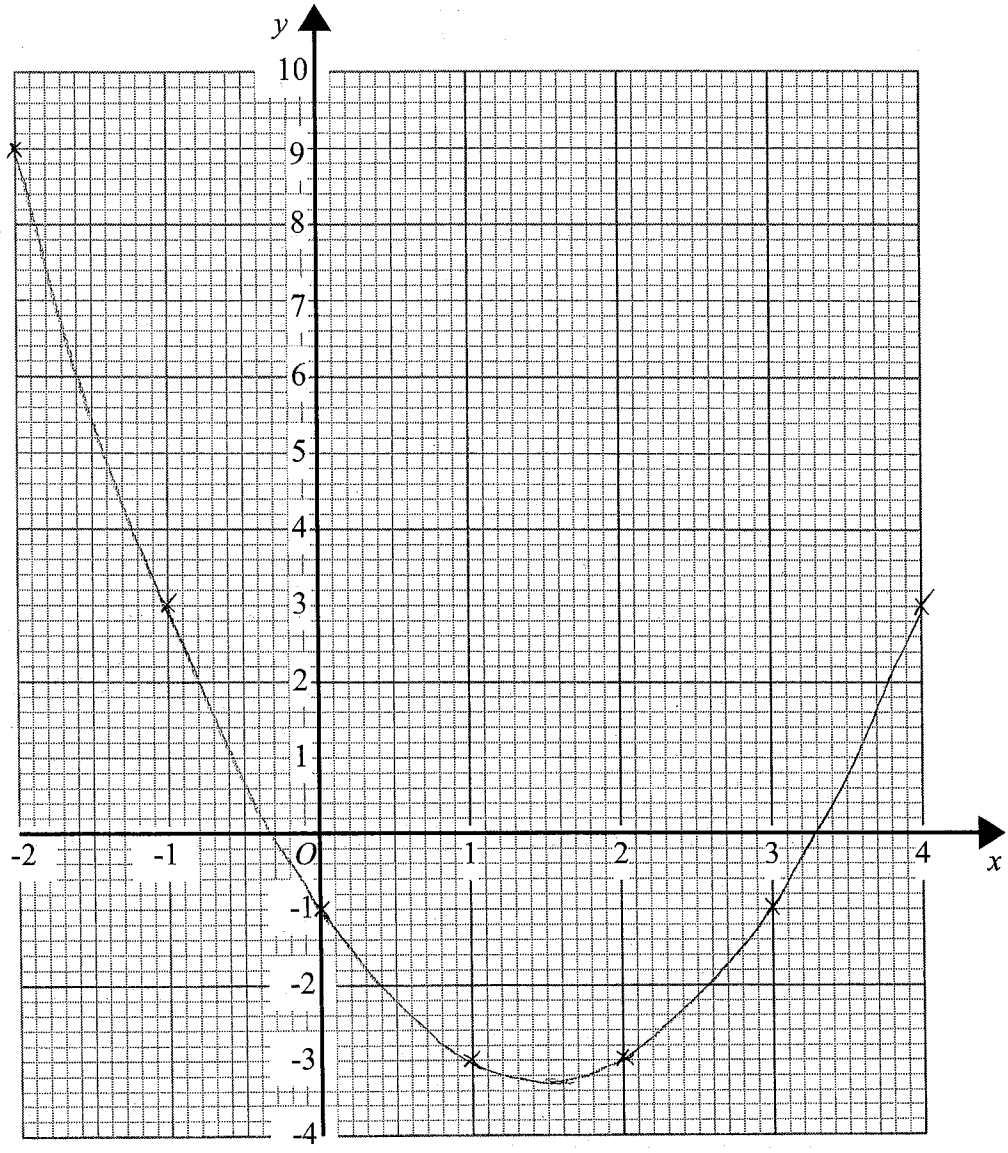
(Total for question 4 is 6 marks)

-2.6 to -2.5
1.5 to 1.6

5 Complete the table of values for $y = x^2 - 3x - 1$

x	-2	-1	0	1	2	3	4
y	9	3	−1	−3	−3	−1	3

(2)



(a) On the grid draw the graph of $y = x^2 - 3x - 1$ for values of x from –2 to 4 (2)

(b) Use the graph to find an estimate of the turning point of the graph $y = x^2 - 3x - 1$

(1.5, -3.25)

(2)

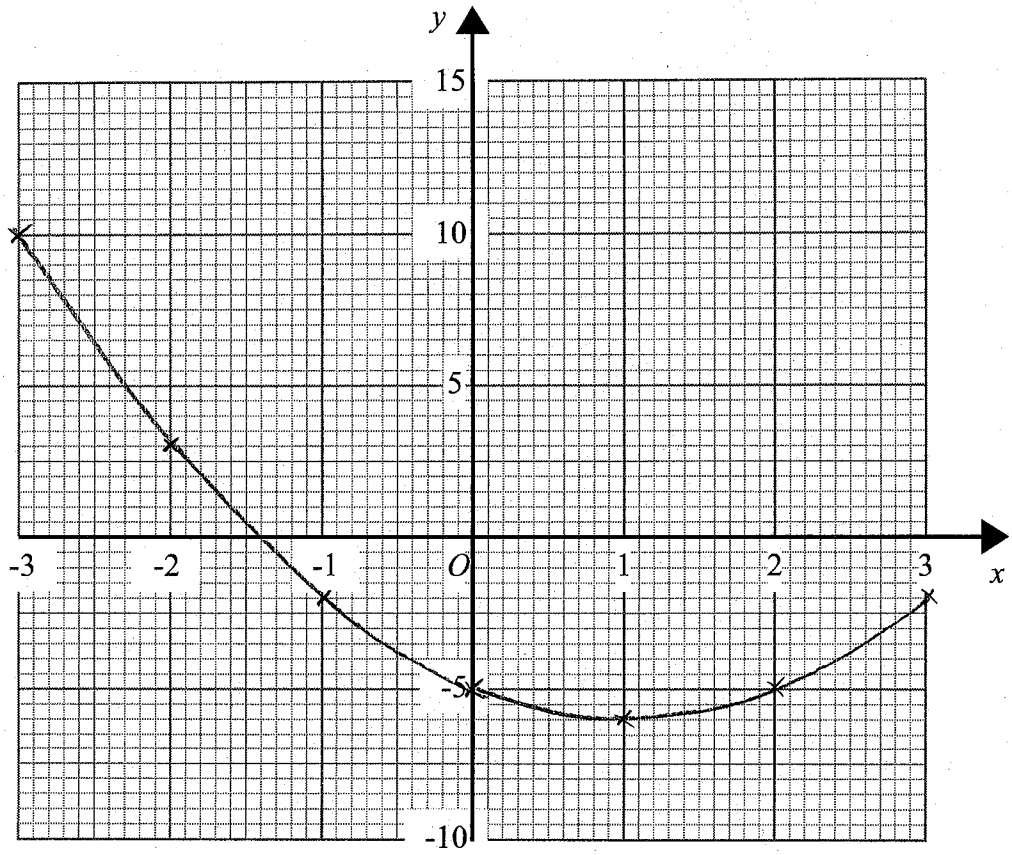
(Total for question 5 is 6 marks)

x: 1.5 only y: -3.1 to -3.5

6 Complete the table of values for $y = x^2 - 2x - 5$

x	-3	-2	-1	0	1	2	3
y	10	3	-2	-5	-6	-5	-2

(2)



(a) On the grid draw the graph of $y = x^2 - 2x - 5$ for values of x from –3 to 3 (2)

(b) Use the graph to find ~~estimates~~ an estimate ~~of~~ a ~~the~~ solution ~~s~~ to the equation $x^2 = 2x + 5$

-1.4

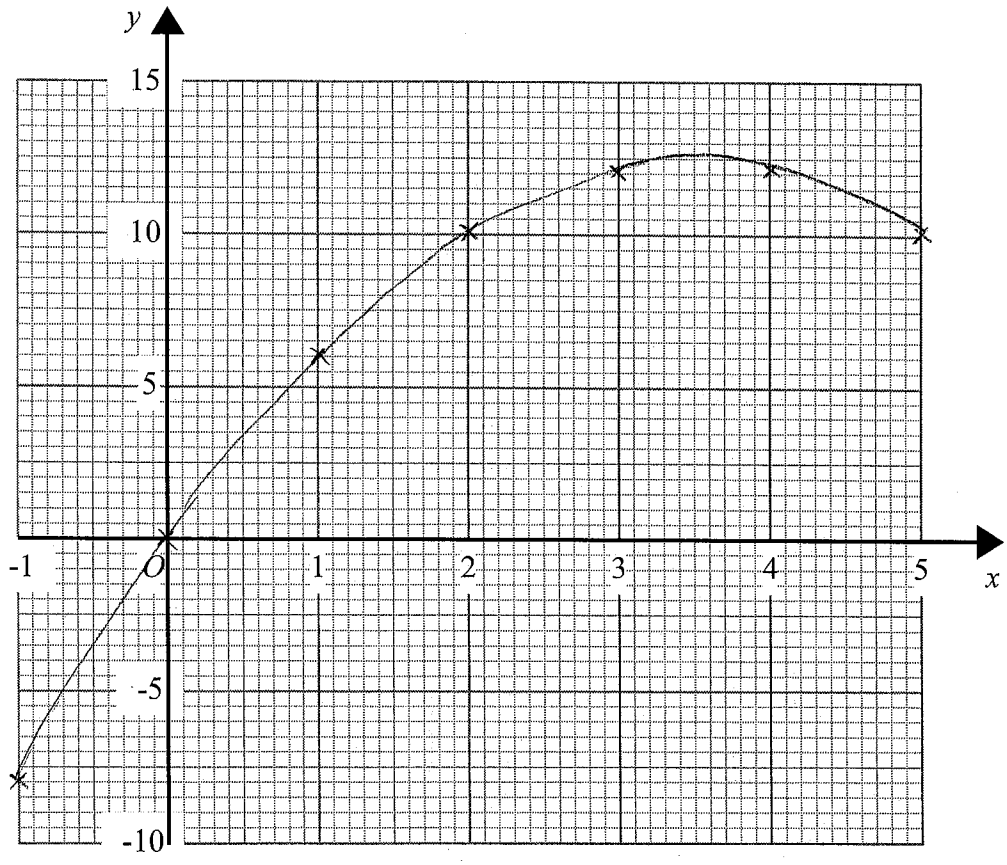
-1.5 to -1.3 ~~(2)~~ 1

(Total for question 6 is 6 marks)

7 Complete the table of values for $y = 7x - x^2$

x	-1	0	1	2	3	4	5
y	−8	0	6	10	12	12	10

(2)



(a) On the grid draw the graph of $y = 7x - x^2$ for values of x from –1 to 5 (2)

(b) Use the graph to find an estimate of the turning point of the graph $y = 7x - x^2$

3.5, 12.5

3.5 only, 12 -13 (2)

(c) Find the solutions to the equation $7x - x^2 = 0$

$x(7 - x) = 0$

$x = 0 \quad x = 7$

$x = 0 \quad x = 7$

(2)

(Total for question 7 is 8 marks)

Name: _____

GCSE (1 – 9)

Solving Quadratics by Factorising

Instructions

- Use **black** ink or ball-point pen.
- Answer all Questions.
- Answer the Questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- 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

1 (a) Factorise $a^2 + 3a - 28$

28

1 28

2 14

4 7

$(a+7)(a-4)$

(2)

(b) Solve $a^2 + 3a - 28 = 0$

$a = -7$ or $a = 4$

(1)

(Total for Question 1 is 3 marks)

---

2 (a) Factorise $x^2 - 7x + 10$

10

1 10

2 5

$(x-2)(x-5)$

(2)

(b) Solve $x^2 - 7x + 10 = 0$

$x = 2$ or $x = 5$

(1)

(Total for Question 2 is 3 marks)

3 (a) Factorise $b^2 + 9b + 20$

20
1 20
2 10
4 5

$(b + 4)(b + 5)$

(2)

(b) Solve $b^2 + 9b + 20 = 0$

$b = -4$ or $b = -5$

(1)

(Total for Question 3 is 3 marks)

---

4 (a) Factorise $x^2 - 3x - 18$

18
1 18
2 9
3 6

$(x + 3)(x - 6)$

(2)

(b) Solve $x^2 - 3x - 18 = 0$

$x = -3$ or $x = 6$

(1)

(Total for Question 4 is 3 marks)

5 (a) Factorise $y^2 - 10y + 9$

9
1 9
3 3

$(y-1)(y-9)$

(2)

(b) Solve $y^2 - 10y + 9 = 0$

$y = 1$ or $y = 9$

(1)

(Total for Question 5 is 3 marks)

---

6 (a) Factorise $a^2 - a - 56$

56
1 56
2 28
4 14
7 8

$(a+7)(a-8)$

(2)

(b) Solve $a^2 - a - 56 = 0$

$a = -7$ or $a = 8$

(1)

(Total for Question 6 is 3 marks)

7 Solve $x^2 + 14x + 24 = 0$

	24
1	24
2	12
3	8
4	6

$(x + 2)(x + 12) = 0$

$x = -2 \quad x = -12$

$x = -2$ or $x = -12$

(Total for Question 7 is 3 marks)

---

8 Solve $x^2 + 5x - 6 = 0$

	6
1	6
2	3

$(x - 1)(x + 6) = 0$

$x = 1 \quad x = -6$

$x = 1$ or $x = -6$

(Total for Question 8 is 3 marks)

---

9 Solve $x^2 + 5x + 6 = 0$

$(x + 2)(x + 3) = 0$

$x = -2 \quad x = -3$

$x = -2$ or $x = -3$

(Total for Question 9 is 3 marks)

10 Solve $x^2 - 12x + 32 = 0$

32

1 32

2 16

4 8

$(x - 4)(x - 8) = 0$

$x = 4 \quad x = 8$

$x = 4$ or $x = 8$

(Total for Question 10 is 3 marks)

11 Solve $x^2 + 19x + 90 = 0$

90

1 90

2 45

3 30

5 18

6 15

9 10

$(x + 9)(x + 10) = 0$

$x = -9 \quad x = -10$

$x = -9$ or $x = -10$

(Total for Question 11 is 3 marks)

12 Solve $x^2 + 11x - 42 = 0$

42

1 42

2 21

3 14

6 7

$(x - 3)(x + 14) = 0$

$x = 3 \quad x = -14$

$x = 3$ or $x = -14$

(Total for Question 12 is 3 marks)

13 Solve $a^2 - 10a + 16 = 0$

16

1 16

2 8

4 4

$(a - 2)(a - 8) = 0$

$a = 2 \quad a = 8$

$a = 2$ or $a = 8$

(Total for Question 13 is 3 marks)

14 Solve $y^2 - 2y - 35 = 0$

35

1 35

5 7

$(y + 5)(y - 7) = 0$

$y = -5 \quad y = 7$

$y = -5$ or $y = 7$

(Total for Question 14 is 3 marks)

15 Solve $x^2 + 3x - 54 = 0$

54

1 54

2 27

3 18

6 9

$(x + 9)(x - 6) = 0$

$x = -9 \quad x = 6$

$x = -9$ or $x = 6$

(Total for Question 15 is 3 marks)

16 Solve $b^2 - 10b - 24 = 0$

24

1 24
2 12
3 8
4 6

$(b + 2)(b - 12) = 0$

$b = -2 \quad b = 12$

$b = -2$ or $b = 12$

(Total for Question 16 is 3 marks)

17 Solve $m^2 + 13m + 40 = 0$

40

1 40
2 20
4 10
5 8

$(m + 5)(m + 8) = 0$

$m = -5 \quad m = -8$

$m = -5$ or $m = -8$

(Total for Question 17 is 3 marks)

18 Solve $x^2 + 10x - 24 = 0$

24

1 24
2 12
3 8
4 6

$(x + 12)(x - 2) = 0$

$x = -12 \quad x = 2$

$x = -12$ or $x = 2$

(Total for Question 18 is 3 marks)

Name: _____

GCSE (1 – 9)

Expanding and Factorising Quadratics

Instructions

- Use **black** ink or ball-point pen.
- Answer all Questions.
- Answer the Questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- 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

1 Expand and simplify $(x + 7)(x - 3)$

$x^2 - 3x + 7x - 21$

$x^2 + 4x - 21$

(Total for Question 1 is 2 marks)

---

2 (a) Expand and simplify $(2p - 3)(p - 5)$

$2p^2 - 10p - 3p + 15$

$2p^2 - 13p + 15$

(2)

(b) Factorise $a^2 + 15a + 36$

36

1	36
2	18
3	12
4	9
6	6

$(a + 3)(a + 12)$

$(a + 3)(a + 12)$

(2)

(Total for Question 2 is 4 marks)

---

3 (a) Expand and simplify $(x + 3)(x - 3)$

$x^2 - 3x + 3x - 9$

$x^2 - 9$

(2)

(b) Factorise $x^2 - 8x + 7$

7

1 7

$(x - 1)(x - 7)$

(2)

(Total for Question 3 is 4 marks)

4 Expand and simplify $(m + 3)(m + 4)$

$m^2 + 4m + 3m + 12$

$m^2 + 7m + 12$

(Total for Question 4 is 2 marks)

---

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

$6x^2 - 2x + 9x - 3$

$6x^2 + 7x - 3$

(2)

(b) Factorise $x^2 + 10x + 25$

25

1 25

5 5

$(x + 5)(x + 5)$

(1)

(Total for Question 5 is 3 marks)

---

6 (a) Expand and simplify $(4y + 3)(2y - 3)$

$8y^2 - 12y + 6y - 9$

$8y^2 - 6y - 9$

(2)

(b) Factorise $x^2 + 7x + 6$

6

1 6

2 3

$(x + 1)(x + 6)$

(2)

(Total for Question 6 is 4 marks)

7 Expand and simplify $(x-2)(x-9)$

$x^2 - 9x - 2x + 18$

$x^2 - 11x + 18$

(Total for Question 7 is 2 marks)

---

8 (a) Expand and simplify $(5h+2)(h+4)$

$5h^2 + 20h + 2h + 8$

$5h^2 + 22h + 8$

(2)

(b) Factorise $x^2 - 49$

$(x+7)(x-7)$

(1)

(Total for Question 8 is 3 marks)

---

9 (a) Expand and simplify $(3x-5)(2x-3)$

$6x^2 - 9x - 10x + 15$

$6x^2 - 19x + 15$

(2)

(b) Factorise $n^2 - 3n - 18$

1	18
2	9
3	6

$(n+3)(n-6)$

(2)

(Total for Question 9 is 4 marks)

10 Expand and simplify $(x + 6)(3x + 8)$

$3x^2 + 8x + 18x + 48$

$3x^2 + 26x + 48$

(Total for Question 10 is 2 marks)

---

11 (a) Expand and simplify $(x - 6)(x - 7)$

$x^2 - 7x - 6x + 42$

$x^2 - 13x + 42$

(2)

(b) Factorise $x^2 - 16$

$(x + 4)(x - 4)$

(1)

(Total for Question 11 is 3 marks)

---

12 (a) Expand and simplify $(2x + 1)(5x - 9)$

$10x^2 - 18x + 5x - 9$

$10x^2 - 13x - 9$

(2)

(b) Factorise $x^2 - 13x + 36$

36

1 36
2 18
3 12
4 9
6 6

$(x - 4)(x - 9)$

(2)

(Total for Question 12 is 4 marks)

13 Expand and simplify $(a-7)^2$

$(a-7)(a-7)$

$a^2 - 7a - 7a + 49$

$a^2 - 14a + 49$

(Total for Question 13 is 2 marks)

---

14 (a) Expand and simplify $(2x-1)(x+4)$

$2x^2 + 8x - x - 4$

$2x^2 + 7x - 4$

(2)

(b) Factorise $x^2 - 100$

$(x+10)(x-10)$

(1)

(Total for Question 14 is 3 marks)

---

15 (a) Expand and simplify $(3d-2)(d+7)$

$3d^2 + 21d - 2d - 14$

$3d^2 + 19d - 14$

(2)

(b) Factorise $x^2 - 3x - 40$

40

1	40
2	20
4	10
5	8

$(x+5)(x-8)$

(2)

(Total for Question 15 is 4 marks)

16 Factorise $n^2 + 3n - 28$

28
1 28
2 14
4 7

$(n+7)(n-4)$

(Total for Question 16 is 2 marks)

17 (a) Expand and simplify $(a-5)(a+6)$

$a^2 + 6a - 5a - 30$

$a^2 + a - 30$

(2)

(b) Factorise $b^2 - 81$

$(b+9)(b-9)$

(1)

(Total for Question 17 is 3 marks)

18 (a) Expand and simplify $(2x+5)(x+9)$

$2x^2 + 18x + 5x + 45$

$2x^2 + 23x + 45$

$2x^2 + 23x + 45$

(2)

(b) Factorise $y^2 - 7y + 12$

12
1 12
2 6
3 4

$(y-3)(y-4)$

(2)

(Total for Question 18 is 4 marks)

19 Factorise $m^2 - m - 30$

30
1 30
2 15
3 10
5 6

$(m + 5)(m - 6)$

(Total for Question 19 is 2 marks)

---

20 (a) Expand and simplify $(5a - 1)(2a - 7)$

$10a^2 - 35a - 2a + 7$

$10a^2 - 37a + 7$

(2)

(b) Factorise $b^2 - 144$

$(b + 12)(b - 12)$

(1)

(Total for Question 20 is 3 marks)

---

21 (a) Expand and simplify $(7x + 1)(x + 5)$

$7x^2 + 35x + x + 5$

$7x^2 + 36x + 5$

(2)

(b) Factorise $y^2 + 13y + 30$

1 30
2 15
3 10
5 6

$(y + 3)(y + 10)$

(2)

(Total for Question 21 is 4 marks)

Name: _____

GCSE (1 – 9)

Changing the Subject of a Formula

Instructions

- Use **black** ink or ball-point pen.
- Answer all Questions.
- Answer the Questions in the spaces provided
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- You must **show all your working out.**

Information

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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

1 $f = 5c - 8$

Make c the subject of the formula.

$f = 5c - 8$

$+8 \qquad +8$

$\frac{f+8}{5} = \frac{5c}{5}$

$c = \frac{f+8}{5}$

$c = \frac{f+8}{5}$

(Total for question 1 is 2 marks)

2 $u = 4t - 21$

Make t the subject of the formula.

$u = 4t - 21$

$+21 \qquad +21$

$\frac{u+21}{4} = \frac{4t}{4}$

$t = \frac{u+21}{4}$

$t = \frac{u+21}{4}$

(Total for question 2 is 2 marks)

3 $x = 3y - 2$

Make y the subject of the formula.

$x = 3y - 2$

$+2 \qquad +2$

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

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

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

(Total for question 3 is 2 marks)

4 $m = 5n + 2p$

Make p the subject of the formula.

$m = 5n + 2p$

$-5n \quad -5n$

$\frac{m - 5n}{2} = \frac{2p}{2}$

$p = \frac{m - 5n}{2}$

$p = \frac{m - 5n}{2}$

(Total for question 4 is 2 marks)

5 $a = 3c - 2$

Make c the subject of the formula.

$a = 3c - 2$

$+2 \quad +2$

$\frac{a + 2}{3} = \frac{3c}{3}$

$c = \frac{a + 2}{3}$

$c = \frac{a + 2}{3}$

(Total for question 5 is 2 marks)

6 $P = 3a + 3b$

Make a the subject of the formula.

$P = 3a + 3b$

$-3b \quad -3b$

$\frac{P - 3b}{3} = \frac{3a}{3}$

$a = \frac{P - 3b}{3}$

$a = \frac{P - 3b}{3}$

(Total for question 6 is 2 marks)

7 Make n the subject of $m = n^2 + 3$

$m = n^2 + 3$

$-3 \quad -3$

$m - 3 = n^2$

$n = \pm\sqrt{m-3}$

accept $n = \sqrt{m-3}$

$n = \pm\sqrt{m-3}$

(Total for question 7 is 2 marks)

8 Make a the subject of $v = u + at$

$v = u + at$

$-u \quad -u$

$\frac{v-u}{t} = \frac{at}{t}$

$a = \frac{v-u}{t}$

$a = \frac{v-u}{t}$

(Total for question 8 is 2 marks)

9 Make a the subject of $v^2 = u^2 + 2as$

$v^2 = u^2 + 2as$

$-u^2 \quad -u^2$

$\frac{v^2-u^2}{2s} = \frac{2as}{2s}$

$a = \frac{v^2-u^2}{2s}$

$a = \frac{v^2-u^2}{2s}$

(Total for question 9 is 2 marks)

10 Make b the subject of $a = \sqrt{\frac{b+2}{5}}$

$$a^2 = \left(\sqrt{\frac{b+2}{5}}\right)^2$$

$$5 \times a^2 = \frac{b+2}{5} \times 5$$

$$5a^2 = b + 2$$

$$-2 \qquad -2$$

$$5a^2 - 2 = b$$

$b = 5a^2 - 2$

(Total for question 10 is 3 marks)

---

11 Make b the subject of $A = 3b + 9$

$$A = 3b + 9$$

$$-9 \qquad -9$$

$$\frac{A - 9}{3} = \frac{3b}{3}$$

$$b = \frac{A - 9}{3}$$

$b = \frac{A-9}{3}$

(Total for question 11 is 2 marks)

12 Make x the subject of $y = 3x - 2$

$y = 3x - 2$

$+2 \qquad +2$

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

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

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

(Total for question 12 is 2 marks)

13 Make x the subject of $y = \frac{1}{2}x + 6$

$y = \frac{1}{2}x + 6$

$-6 \qquad -6$

$y - 6 = \frac{1}{2}x$

$\times 2 \qquad \times 2$

$2(y-6) = x$

OR $x = 2y - 12$

$x = 2(y-6)$

(Total for question 13 is 2 marks)

14 Make x the subject of $y = \frac{2}{5}x - 12$

$y = \frac{2}{5}x - 12$

$+12 \qquad +12$

$y + 12 = \frac{2}{5}x$

$\times 5 \qquad \times 5$

$\frac{5(y+12)}{2} = \frac{2x}{2}$

$x = \frac{5(y+12)}{2}$

$x = \frac{5(y+12)}{2}$

(Total for question 14 is 3 marks)

15 Make x the subject of $5x + 6y + 12 = 0$

$-6y \quad -6y$

$5x + 12 = -6y$

$-12 \qquad -12$

$5x = -6y - 12$

$x = \dfrac{-6y - 12}{5}$

$x = \dfrac{-6y - 12}{5}$

(Total for question 15 is 2 marks)

---

16 Make x the subject of $y = x^3 - 5$

$+5 \quad +5$

$y + 5 = x^3$

$x = \sqrt[3]{y + 5}$

$x = \sqrt[3]{y + 5}$

(Total for question 16 is 2 marks)

---

17 Make x the subject of $y = \dfrac{2x + 3}{4}$

$\times 4 \qquad \times 4$

$4y = 2x + 3$

$-3 \qquad -3$

$\dfrac{4y - 3}{2} = \dfrac{2x}{2}$

$x = \dfrac{4y - 3}{2}$

$x = \dfrac{4y - 3}{2}$

(Total for question 17 is 3 marks)

18 Make a the subject of $x = 3(a + 9)$

$x = 3a + 27$

$-27 \qquad -27$

$\frac{x - 27}{3} = \frac{3a}{3}$

$a = \frac{x - 27}{3}$

OR $a = \frac{x}{3} - 9$

$a = \frac{x - 27}{3}$

(Total for question 18 is 2 marks)

19 $a = \frac{3 + c}{b}$

Make b the subject of the formula.

$ab = 3 + c$

$b = \frac{3 + c}{a}$

$b = \frac{3 + c}{a}$

(Total for question 19 is 2 marks)

20 $d = \sqrt{\frac{3h}{2}}$

Make h the subject of the formula.

$d^2 = \frac{3h}{2}$

$\frac{2d^2}{3} = \frac{3h}{3}$

$h = \frac{2d^2}{3}$

$h = \frac{2d^2}{3}$

(Total for question 20 is 3 marks)

Name: _____

GCSE (1 – 9)

Compound Measures

Instructions

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- Answer the questions in the spaces provided
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- You must **show all your working out.**

Information

- 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

1 A sprinter runs a distance of 200 metres in 25 seconds.
Work out the average speed of the sprinter.

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{200}{25} = 8 \text{ m/s}$$

8 ..... m/s

(Total for question 1 is 1 mark)

---

2 A block exerts a force of 120 Newtons on the ground.
The block has an area of 2 m^2.

Work out the pressure on the ground.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

$$\text{pressure} = \frac{120}{2} = 60 \text{ N/m}^2$$

60 ..... N/ m^2

(Total for question 2 is 1 mark)

---

3 A piece of gold has a mass of 760 grams and a volume of 40 cm^3.
Work out the density of the piece of gold.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

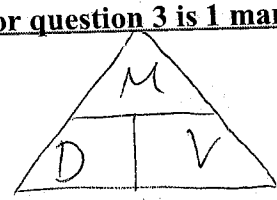
$$= \frac{760}{40} = 19 \text{ g/cm}^3$$

19 ..... g/cm^3

(Total for question 3 is 1 mark)

---

4 A rock has a mass of 56 grams and a density of 3.5 grams/cm^3.
Work out the volume of the rock.



$$\text{volume} = \frac{\text{mass}}{\text{density}}$$

$$= \frac{56}{3.5} = \frac{112}{7} = 16 \text{ cm}^3$$

16 ..... cm^3

(Total for question 4 is 1 mark)

5 A car travels a distance of 230 miles in 4 hours and 15 minutes.
Work out the average speed of the car, in miles per hour.
Give your answer to 1 decimal place.

4.25 hours

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{230}{4.25}$$

$$= 54.1 \text{ mph}$$

54.1 ..... miles/hour

(Total for question 5 is 2 marks)

6 A block exerts a force of 84 Newtons on a table.
The pressure on the table is 30 N/m^2.

Work out the area of the box that is in contact with the table.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

$$\text{area} = \frac{\text{force}}{\text{pressure}}$$

$$= \frac{84}{30} = 2.8 m^2$$

2.8 ..... m^2

(Total for question 6 is 2 marks)

7 A liquid has a density of 1.3 grams per ml.
Find the mass of 250 ml of the liquid.

$$\text{mass} = \text{density} \times \text{volume}$$

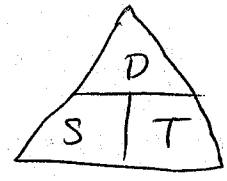
$$= 1.3 \times 250$$

$$= 325 g$$

325 ..... g

(Total for question 7 is 1 mark)

8 Dani leaves her house at 08 00.
She drives 63 miles to work.
She drives at an average speed of 27 miles per hour.
At what time does Dani arrive at work?



$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{63}{27}$$

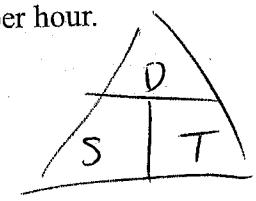
$$= 2.\dot{3} \text{ hours}$$

$$= 2 \text{ hours } 20 \text{ mins}$$

10:20 .....

(Total for question 8 is 2 marks)

9 Anthony travels from Newcastle to Manchester at an average speed of 65 miles per hour.
The journey takes him 2 hours and 15 minutes. 2.25 hours



Declan makes the same journey in 2 hours and 35 minutes.

(a) Work out Declan's average speed for the journey.

Anthony: distance = speed × time
= 65 × 2.25
= 146.25 miles

Declan: speed = distance / time
= 146.25 / 2.583
= 56.6 miles/hour (1dp)

2hrs 35 mins

$\frac{35}{60} = 0.583$ OR $\frac{7}{12}$

56.6 mph

(4)

(b) If Declan ~~stopped for a break during~~ his journey, how ~~would~~ this affect your answer to part (a)?

took a different roads for could

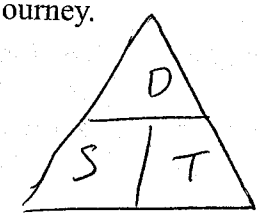
The ans: If the distance was increased the speed would be higher.
(If the distance decreased the speed would be lower)

(1)

(Total for question 9 is 5 marks)

10 Rachel drives 300 miles from London to Newcastle.
She drives the first 165 miles at an average speed of 60 mph.
From this point it takes Rachel 3 hours and 15 minutes to complete her journey.

What was Rachel's average speed for the whole journey?



FIRST 165 MILES

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{165}{60} = 2.75 \text{ hours}$$

$$= 2 \text{ hours } 45 \text{ mins}$$

2 hours 45 + 3 hours 15 = 6 hours

~~135 MILES LEFT~~

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

$$= \frac{300}{6}$$

$$= 50 \text{ mph}$$

50 ..... mph

(Total for question 10 is 4 marks)

11 Andrew ran 3.1 miles in 14 minutes and 35 seconds.

He assumes he can run 8 miles at the same speed.

(a) Work out how long it would take Andrew to run 8 miles.

Give your answer in minutes and seconds to the nearest second.

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

$$= \frac{3.1}{14.583}$$

$$= 0.21257\ldots \text{ miles/min}$$

14 mins 35 secs

$= 14.583\dot{3}$ mins

~~distance = speed × time~~

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

$$= \frac{8}{0.21257} = 37 \text{ mins } 38 \text{ sec}$$

37 mins 38 secs

(4)

Andrew's speed actually decreases the further he goes.

(b) How does this affect your answer to part (a)?

It would take longer to run 8 miles (the answer would be higher)

(1)

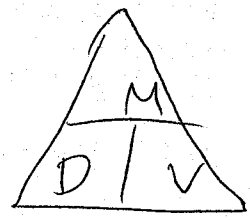
(Total for question 11 is 5 marks)

12 Liquid **A** has a density of 1.2 g/cm^3

150 cm^3 of Liquid **A** is mixed with some of Liquid **B** to make Liquid **C**.

Liquid **C** has a mass of 210 g and a density of 1.12 g/cm^3

Find the density of Liquid **B**.



Liquid A : mass = density × volume

= 1.2 × 150

= 180 g

Liquid C volume = $\frac{\text{mass}}{\text{density}}$

= $\frac{210}{1.12}$

= 187.5 cm^3

Liquid B Volume = Liquid C − Liquid A

= 187.5 − 150

= 37.5 cm^3

Liquid B mass = Liquid C − Liquid A

= 210 − ~~150~~ 180

= 30 g

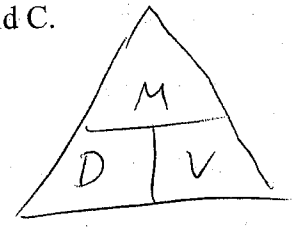
Liquid B density = $\frac{\text{mass}}{\text{volume}}$ = $\frac{30}{37.5}$ = 0.8

0.8 g/cm^3

(Total for question 12 is 3 marks)

13 100ml of liquid A and 200ml of liquid B are mixed together to make liquid C.
Liquid A has a density of 0.7g/ml.
Liquid B has a density of 1.1 g/ml.

Work the density of liquid C.



Liquid A: mass = density × volume

= 0.7 × 100

= 70 g

Liquid B: mass = 1.1 × 200

= 220 g

Liquid C density = $\frac{\text{total mass}}{\text{total volume}}$

= $\frac{70 + 220}{100 + 200}$

= $\frac{290}{300}$

= 0.96 g/ml

0.96 ..... g/ml

(Total for question 13 is 4 marks)

[$\frac{29}{30}$]

Name: _____

GCSE (1 – 9)

Standard Form

Instructions

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Advice

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1 (a) Write 1.2×10^5 as an ordinary number.

120 000

(1)

(b) Write 0.003 in standard form.

3×10^{-3}

(1)

(Total for Question 1 is 2 marks)

---

2 (a) Write 42 900 000 in standard form.

4.29×10^7

(1)

(b) Write 3.61×10^{-3} as an ordinary number.

0.00361

(1)

(Total for Question 2 is 2 marks)

---

3 (a) Write 9.516×10^6 as an ordinary number.

9516000

(1)

(b) Write 0.0724 in standard form.

7.24×10^{-2}

(1)

(c) Calculate $(8.694 \times 10^2) \div (6.21 \times 10^{-3})$
Give your answer in standard form.

Type in calculator

1400000

1.4×10^5

(2)

(Total for Question 3 is 4 marks)

4 (a) Write 5.12×10^{-5} as an ordinary number.

0.0000512

(1)

(b) Write 5 600 000 in standard form.

5.6×10^{6}

(1)

(Total for Question 4 is 2 marks)

---

5 (a) Write 0.0065 in standard form.

6.5×10^{-3}

(1)

(b) Write 3×10^{4} as an ordinary number.

30 000

(1)

(Total for Question 5 is 2 marks)

---

6 (a) Write 3.08×10^{-5} as an ordinary number.

0.0000308

(1)

(b) Write 5 million in standard form.

5 000 000

5×10^{6}

~~500~~

(1)

(c) Calculate $(6.3 \times 10^{5}) \times (2.5 \times 10^{-2})$
Give your answer in standard form.

15750

1.575×10^{4}

(2)

(Total for Question 6 is 4 marks)

7 Work out $(8.69 \times 10^{-5}) \div (5.5 \times 10^{-7})$
Give your answer in standard form.

158

1.58×10^{2}

(Total for Question 7 is 2 marks)

---

8 (a) Write 0.00931 in standard form.

9.31×10^{-3}

(b) Write 7.429×10^{3} as an ordinary number. (1)

7429

(1)

(Total for Question 8 is 2 marks)

---

9 (a) Write 5.2×10^{-1} as an ordinary number.

0.52

(1)

(b) Work out the value of $(3.2 \times 10^{3}) \times (6.5 \times 10^{4})$
Give your answer in standard form.

208 000 000

2.08×10^{8}

(2)

(Total for Question 9 is 3 marks)

---

10 Write 0.21×10^{6} in standard form.

$0.21 \times 10 \times 10^{5}$

2.1×10^{5}

(Total for Question 10 is 1 mark)

11 Work out $(6.7 \times 10^4) \times (3.4 \times 10^{-8})$
Give your answer as an ordinary number.

2.278×10^{-3}

0.002278

(Total for Question 11 is 2 marks)

---

12 Work out $\dfrac{0.03 \times 0.02}{0.008}$

Give your answer in standard form.

without a calculator:

$$\frac{3 \times 10^{-2} \times 2 \times 10^{-2}}{8 \times 10^{-3}}$$

$$\frac{6 \times 10^{-4}}{8 \times 10^{-3}} = 0.75 \times 10^{-1}$$

$$= 7.5 \times 10^{-2}$$

7.5×10^{-2}

(Total for Question 12 is 3 marks)

---

13 Work out $\dfrac{3.744 \times 10^9}{2.4 \times 10^5}$

Give your answer in standard form.

15600

1.56×10^4

(Total for Question 13 is 2 marks)

---

14 Work out the value of $(5 \times 10^3) \times (6 \times 10^7)$
Give your answer in standard form.

without calc: 30×10^{10}

3×10^{11}

3×10^{11}

(Total for Question 14 is 2 marks)

15 (a) Write 0.000 054 376 in standard form.

5.4376×10^{-5}

(1)

(b) Write 4.15×10^6 as an ordinary number.

4 150 000

(1)

(c) Work out $\dfrac{4.1\times10^5 \times 7.3\times10^4}{2\times10^{-6}}$

1.4965×10^{16}

(2)

(Total for Question 15 is 4 marks)

---

16 Write these numbers in order of size.
Start with the smallest number.

6.1×10^2	0.061×10^2	6100×10^{-4}	61
610	6.1	0.61	61

6100×10^{-4} 0.061×10^2 61 6.1×10^2

(Total for Question 16 is 2 marks)

---

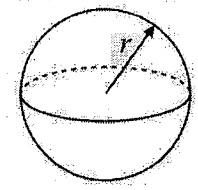
17 A sphere has a radius of 6.4×10^6 metres.
Calculate the volume of this sphere.

Give your answer in standard form to 1 decimal place.

$\frac{4}{3}\pi(6.4\times10^6)^3$

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

Surface area of sphere $= 4\pi r^2$



1.1×10^{21} m^3

(Total for Question 17 is 3 marks)

18 A large rock has a weight of 1.2×10^4 grams.

Find, in standard form, the weight of 12 of these large rocks.

$1.2 \times 10^4 \times 12$

$1.2 \times 10^4 \times 1.2 \times 10^1$

1.44×10^5 grams

(Total for Question 18 is 2 marks)

---

19 Write these numbers in order of size.
Start with the smallest number.

3.5×10^2	0.035×10^5	350×10^{-2}	35×10^0
350	3500	3.5	35

350×10^{-2} 35×10^0 3.5×10^2 0.035×10^5

(Total for Question 19 is 2 marks)

---

20 The diameter of Neptune is 5.0×10^4 km
The diameter of Mars is 6.8×10^3 km
Calculate the difference between the diameter of Neptune and the diameter of Mars.
Give your answer in standard form.

$5 \times 10^4 = 50000$

$6.8 \times 10^3 = 6800$

$50000 - 6800 = 43200$

4.32×10^4 km

(Total for Question 20 is 2 marks)

---

21 One electron has a mass of 9.1×10^{-31} grams.

Find the mass of 250 of electrons.

$9.1 \times 10^{-31} \times 250$

2.275×10^{-28} grams

(Total for Question 21 is 2 marks)

22 The area of Australia is 7.7×10^6 km^2
The area of Cyprus is 9.3×10^3 km^2
How many times larger is Australia than Cyprus.
Give your answer to the nearest whole number.

$\frac{7.7 \times 10^6}{9.3 \times 10^3} = 827.956...$

828

(Total for Question 22 is 2 marks)

23 The area of the Pacific Ocean is 3.61×10^8 km^2
The area of the Atlantic Ocean is 8.51×10^7 km^2
Find the total area of the Pacific Ocean and the Atlantic Ocean.
Give your answer in standard form.

$3.61 \times 10^8 + 8.51 \times 10^7$

446100000

4.461×10^8 km^2

(Total for Question 23 is 2 marks)

78 000 000

24 The distance between Earth and Mars is 78 million kilometres.
The speed of light is 3×10^5 km/s

D
S T

Calculate the time, in seconds, it takes for light to travel from Earth to Mars.
Give your answer in standard form.

Time $= \frac{78000000}{3 \times 10^5} = \frac{780}{3} = 260$

$= 260$

$= 2.6 \times 10^2$

2.6×10^2 s

(Total for Question 24 is 2 marks)

Name: _____

GCSE (1 – 9)

Reverse Percentages

Instructions

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Information

- 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

1 The value of a house increased by 6%.
The house then had a value of £265 000

Work out the value of the house before the increase.

$x \times 1.06 = 265\,000$

$x = \frac{265\,000}{1.06}$

$= 250000$

OR

$265000 = 106\%$

$\div 106 \quad \div 106$

$2500 = 1\%$

$\times 100 \quad \times 100$

$250\,000 = 100\%$

£ 250000

(Total for Question 1 is 2 marks)

---

2 In a sale, the normal price of a book is reduced by 20%.
The sale price of the book is £4.80

Work out the normal price of the book.

$x \times 0.8 = 4.80$

$x = \frac{4.80}{0.8}$

$= 6$

£ 6

(Total for Question 2 is 2 marks)

---

3 The value of a litre of petrol increased by 8%.
A litre of petrol then cost £1.62

Work out the price of a litre of petrol before the increase.

$x \times 1.08 = 1.62$

$x = \frac{1.62}{1.08}$

$= £1.50$

£ 1.50

(Total for Question 3 is 2 marks)

4 In a sale, normal prices are reduced by 25%.
The normal price of a coat is reduced by £12

Work out the normal price of the coat.

$12 = 25\%$

$\times 4 \qquad \times 4$

$48 = 100\%$

£ 48

(Total for Question 4 is 2 marks)

---

5 In a sale, the normal price of a TV is reduced by 20%.
The sale price of the TV is £660

Work out the normal price of the TV.

$x \times 0.8 = 660$

$x = \frac{660}{0.8}$

$= 825$

£ 825

(Total for Question 5 is 2 marks)

---

6 The cost of a council tax bill increased by 5%.
The council tax bill increased by £62.

Work out the cost of the council tax bill before the increase

$62 = 5\%$

$\times 20 \qquad \times 20$

$1240 = 100\%$

£ 1240

(Total for Question 6 is 2 marks)

7 The price of a train season ticket increased by 4%.
The price of the ticket increased by £152.20

Work out the price of the train ticket before the increase.

$152.20 = 4\%$

$\times 25 \qquad \times 25$

$3805 = 100\%$

£ 3805

(Total for Question 7 is 2 marks)

---

8 In a sale, the normal price of a car is reduced by 30%.
The sale price of the car is £6300

Work out the normal price of the car.

$6300 = 70\%$

$\div 7 \qquad \div 7$

$900 = 10\%$

$\times 10 \qquad \times 10$

$9000 = 100\%$

£ 9000

(Total for Question 8 is 2 marks)

---

9 In a sale, normal prices are reduced by 15%.
The normal price of a pen is reduced by £1.20

Work out the normal price of the pen.

$1.20 = 15\%$

$\div 3 \qquad \div 3$

$0.40 = 5\%$

$\times 20 \qquad \times 20$

$8 = 100\%$

£ 8

(Total for Question 9 is 2 marks)

Name: _____

GCSE (1 – 9)

Direct and Inverse Proportion

Instructions

- Use **black** ink or ball-point pen.
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- You must **show all your working out.**

Information

- 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

1 A machine fills 1000 bottles in 5 hours.

Work out how many hours it would take the machine to fill 1200 bottles.

1000 bottles in 5 hours ↓ ÷5

200 bottles in 1 hour ↓ ↓ ×6

1200 bottles in 6 hours ↓

6

(Total for question 1 is 2 marks)

2 It costs £0.75 to buy 5 bananas.

Work out how much it would cost to buy 7 bananas.

£0.75 for 5 bananas ↓ ÷5

£0.15 for 1 banana ↓ ↓ ×7

£1.05 for 7 bananas ↓

£1.05

(Total for question 2 is 2 marks)

3 3 tins of beans and 4 tins of tomatoes costs £2.73.

5 tins of beans costs £1.55.

Work out how much one tin of tomatoes costs.

5 tins of beans costs £1.55

↓ ÷5

1 tin of beans costs £0.31

↓ ×3

3 tins of beans costs £0.93

2.73 − 0.93 = £1.80

£1.80 for 4 tins of tomatoes

£1.80 ÷ 4 = £0.45

£0.45

(Total for question 3 is 2 marks)

---

4 There are 500 sheets in a pack of paper. 500 sheets of paper weigh 2.5kg.

Work out the weight of 50 sheets of paper.

500 sheets weigh 2.5kg

↓ ÷10

50 sheets weigh 0.25kg

0.25kg

(Total for question 4 is 2 marks)

5 It takes 2 painters 4 days to complete a job.

Inverse proportion.
More painters = Less time.

Work out how many days it would take 1 painter to complete the same job.

2 painters take 4 days

$2 \times 4 = 8$ 8 days of work needed.

8

(Total for question 5 is 2 marks)

6 It takes 3 machines 2 days to produce a batch of products

Work out how long it would take 1 machine to produce the same batch of products.

$3 \times 2 = 6$

6 days of machine work needed

6

(Total for question 6 is 2 marks)

7 It takes 3 painters 6 days to complete a job.

Work out how many days it would take 2 painters to complete the same job.

$3 \times 6 = 18$

18 days of work needed

2 painters $\frac{18}{2} = 9$ days

9

(Total for question 7 is 2 marks)

8 It takes 5 machines 6 hours to produce 1000 DVDs

Work out how long it would take 4 machines to produce 1000 DVDs.

$5 \times 6 = 30$ machine ~~days~~ hours needed

$\frac{30}{4} = 7.5$ hours

7.5 hours

(Total for question 8 is 2 marks)

9 x is inversely proportional to y.

x is given by the formula: $x = \frac{1000}{y}$

Find the value of x when $y = 50$

$$x = \frac{1000}{y}$$

$$x = \frac{1000}{50} = 20$$

$x =$ 20

(Total for question 9 is 2 marks)

---

10 y is directly proportional to x.

y is given by the formula: $y = 0.4x$

Find the value of y when $x = 6$

$$y = 0.4x$$

$$y = 0.4(6)$$

$$y = 2.4$$

$y =$ 2.4

(Total for question 10 is 2 marks)

11 The weight of a piece of wire (w grams) is directly proportional to its length (l cm).

w is given by the formula: $w = 30l$

Find the length of a wire weighing 75 grams.

$$w = 30l$$
$$75 = 30l$$
$$\frac{75}{30} = l$$
$$l = 2.5$$

$l =$ 2.5 cm

(Total for question 11 is 2 marks)

---

12 The force, F, between two magnets is inversely proportional to the square of the distance, x cm, between them.

F is given by the formula: $F = \frac{36}{x^2}$

Find the Force when two magnets are 3 cm apart.

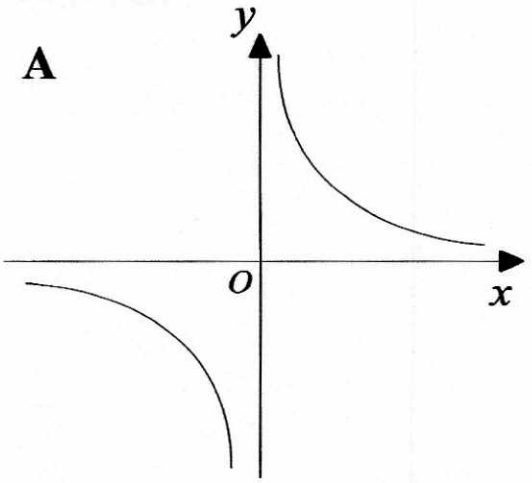
$$F = \frac{36}{x^2}$$
$$= \frac{36}{3^2}$$
$$= \frac{36}{9}$$
$$= 4$$

$F =$ 4 N

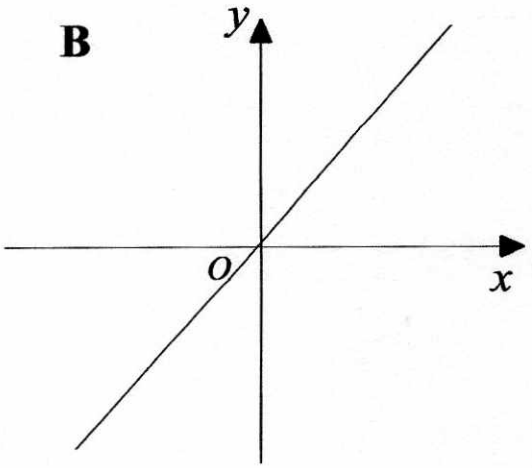
(Total for question 12 is 2 marks)

13 Here are four graphs.

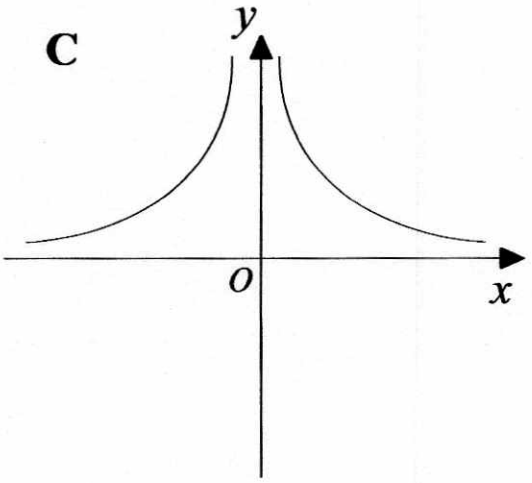
A



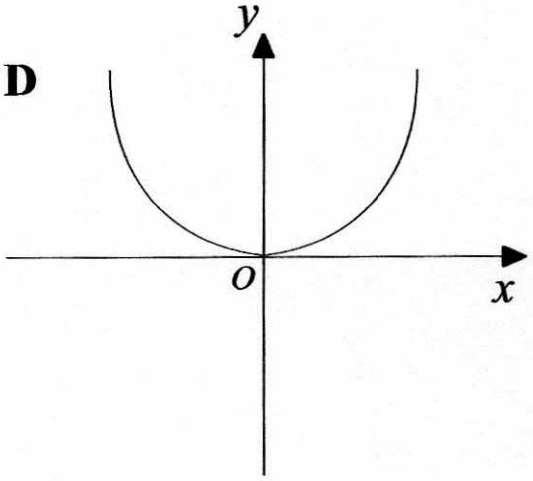
B



C



D



Match each graph with a statement in the table below.

Proportionality relationship	**Graph letter**
y is directly proportional to x	B
y is inversely proportional to x	A
y is directly proportional to x^2	D
y is inversely proportional to x^2	C

(Total for question 13 is 2 marks)

Name: _____

GCSE (1 – 9)

Ratio Problems 2

Instructions

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Information

- 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

1 The ratio of dogs to cats is 5:3
The ratio of fish to dogs is 6:1

Find the ratio of cats to fish.
Give your answer in its simplest form.

D : C
5 : 3

F : D
6 : 1

Make Dogs the same. ×5

D : C
5 : 3

F : D
30 : 5

D : C : F
5 : 3 : 30

C : F
3 : 30
1 : 10

1 : 10

(Total for question 1 is 2 marks)

---

2 Given that $a:b = 4:5$ and $b:c = 3:2$

Find the ratio $a:b:c$
Give your answer in its simplest form.

a : b
4 : 5

b : C
3 : 2

×3 ×5 (MAKE b the SAME)

12 : 15

15 : 10

a : b : C
12 : 15 : 10

12 : 15 : 10

(Total for question 2 is 2 marks)

3 Alfie, Bertie and Charlie share £66.
The amount Alfie and Bertie get is in the ratio 9:5
The amount Bertie and Charlie get is in the ratio 2:1

How much does Alfie get?

A : B
9 : 5
×2 ↓
18 : 10

B : C
2 : 1
×5 (MAKE B THE SAME)
10 : 5

A : B : C
18 : 10 : 5 (33 PARTS)

$\frac{66}{33}$ = £2 (PER PART)

A : B : C
£36 : £20 : £10

£ 36

(Total for question 3 is 3 marks)

---

4 Dylan, Eli and Fabian share some sweets.
The amount of sweets Dylan gets to the amount of sweets Eli gets is in the ratio 7:3
The amount Dylan gets to the amount Fabian gets is in the ratio 4:5

Given Fabian gets 21 more sweets than Dylan.

Work out how many sweets Eli gets.

D : E
7 : 3
×4 ↓
28 : 12

D : F
4 : 5
28 : 35
×7 MAKE D THE SAME

D : E : F
28 : 12 : 35

FABIAN GETS 7 MORE PARTS THAN DYLAN
7 PARTS = 21 SWEETS
1 PART = 3 SWEETS

ELI GETS 12 × 3 = 36 36 sweets

(Total for question 4 is 3 marks)

5 Given that $a:b = 3:7$ and $a:c = 4:3$

Find the ratio $a:b:c$
Give your answer in its simplest form.

a : b
3 : 7
×4 ↓
12 : 28

a : c
4 : 3
×3 ↓ (Make A The Same)
12 : 9

a : b : c
12 : 28 : 9

12 : 28 : 9

(Total for question 5 is 2 marks)

6 Given that $a:c = 1:6$ and $b:c = 2:5$

Find the ratio $a:b:c$
Give your answer in its simplest form.

a : c
1 : 6
×5 ↓
5 : 30

b : c
2 : 5
×6 ↓ Make C the Same
12 : 30

a : b : c
5 : 12 : 30

5 : 12 : 30

(Total for question 6 is 2 marks)

7 There are red sweets, blue sweets and green sweets in a bag.
The ratio of red sweets to sweets that are not red is 2:3
The ratio of green sweets to sweets that are not green is 6:19

Work out the ratio of red sweets to blue sweets to green sweets.

Red to Not Red
2 : 3
5 PARTS
x 5
(10) : 15

Green to Not Green
(6) : 19
25 PARTS

(MAKE THE NUMBER OF PARTS THE SAME.)

R : B : G
10 : 9 : 6

25 − 10 − 6 = 9
BLUE

10 : 9 : 6

(Total for question 7 is 3 marks)

8 A football team plays some games in a season. Each game was a win, a draw or a loss.

The ratio of the games the won to the games they did not win was 9:7
The ratio of games they lost to games they did not lose was 1:7.

Given the team played less than 50 games, work out the highest amount of games they could have won.

win to not win
(9) 7
(16 PARTS)

lose to not lose
1 : 7
(8 PARTS)
x 2
(2) 14

W : D : L
(16) 9 : 5 : 2
(32) 18 : 10 : 4
(48) 27 : 15 : 6

DRAWS
16 − 9 − 2 = 5

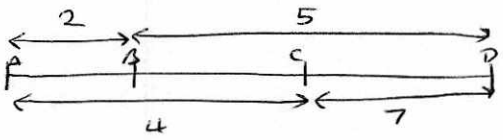
27

(Total for question 8 is 2 marks)

9 The points A, B, C and D lie in order on a straight line.

$AB:BD = 2:5$ and $AC:CD = 4:7$

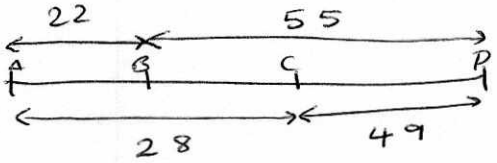
Find $AB:BC:CD$



7 PARTS x 11

11 PARTS x 7

MAKE THE NUMBER OF PARTS THE SAME



77 PARTS

77 PARTS

AB : BC : CD

22 : 6 : 49

BC = 77 − 49 − 22

= 6

22 : 6 : 49

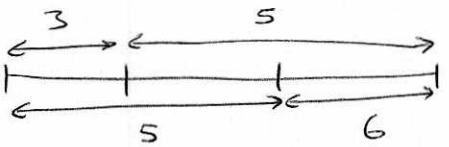
(Total for question 9 is 3 marks)

---

10 The points A, B, C and D lie in order on a straight line.

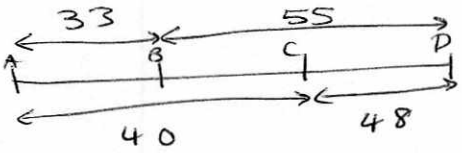
$AB:BD = 3:5$ and $AC:CD = 5:6$

Find $AB:BC:CD$



8 PARTS x 11

11 PARTS x 8



AB : BC : CD

33 : 7 : 48

33 : 7 : 48

(Total for question 10 is 3 marks)

11 Andy and Bruce share some sweets in the ratio 9:4.
Andy gets A sweets
Bruce gets B sweets

Carla and David share the same amount of sweets as Andy and Bruce.
They share their sweets in the ratio 5:2.

Carla gets C sweets
David gets D sweets

Find $A:B:C:D$

A : B
9 : 4
13 PARTS

C : D
5 : 2
7 PARTS

MAKE THE NUMBER OF PARTS THE SAME

x 7
63 : 28

x 13
65 : 26

A : B : C : D
63 : 28 : 65 : 26

63 : 28 : 65 : 26

(Total for question 11 is 3 marks)

12 A and B are in the ratio 5:1
C and D are in the ratio 2:3

Given: $A + B = 2(C + D)$

Find $A:B:C:D$

A : B
5 : 1
6 PARTS
x 5
25 : 5

C : D
2 : 3
5 PARTS
x 6
12 : 18
÷ 2
6 : 9

A + B = 2(C + D)

A : B : C : D
25 : 5 : 6 : 9

(Total for question 12 is 3 marks)

13 Glen and Harper share some money in the ratio 5:2.
Glen gets £*G*
Harper gets £*H*

India and Jade share the same amount of money as Glen and Harper.
They share their money in the ratio 4:7.

India gets £*I*
Jade gets £*J*

Find *G*:*H*:*I*:*J*

G : H I : J
5 : 2 (7) 4 : 7 (11)
×11 ×7
55 : 22 28 : 49

G : H : I : J
55 : 22 : 28 : 49

55 : 22 : 28 : 49

(Total for question 13 is 3 marks)

14 *A* and *B* are in the ratio 4:3
C and *D* are in the ratio 1:5

Given: $3(A + B) = C + D$

Find *A*:*B*:*C*:*D*

A : B C : D
4 : 3 (7) 1 : 5 (6)
×6 ×7
24 : 18 7 : 35
÷3
8 : 6

3 (A+B) = C+D

A : B : C : D
8 : 6 : 7 : 35

8 : 6 : 7 : 35

(Total for question 14 is 3 marks)