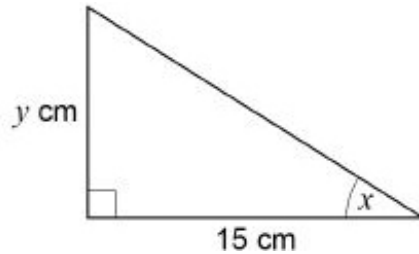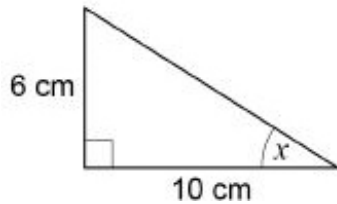# GCSE
# MATHEMATICS (8300)
# HIGHER

Ratio, proportion and rates of change

Total number of marks: 37 per optional item

## Q1

Here are two right-angled triangles.

Not drawn accurately



6 cm

10 cm

$y$ cm

15 cm

$x$

$x$

Circle the value of $y$.

11          7.5          ⬭9⬭          4

**(Total 1 mark)**

## Q11

Ed and Fay shared £330 in the ratio 7 : 4

Ed gives Fay some of his money.

Fay now has the same amount as Ed.

How much does Ed give Fay?

Answer £ ___45___

**(Total 3 marks)**

$330 \rightarrow 7 : 4$

$330 \times \dfrac{7}{11} = 210$

$330 \times \dfrac{4}{11} = 120$

$210 : 120$

$210 - 120$

$= £90$

$\dfrac{}{2}$

$= £45$

**Q11**

Joe and Kyle share an amount of money in the ratio

Joe gets 35% of the money.

Work out the value of $n$.

$J : K$
$7 : n$

$7 \text{ units} = 35\%$
$1 \text{ unit} = 5\%$
$13 \text{ units} = 65\%$

$n = 13$

**(Total 2 marks)**

**Q11**

The value of a house is £120 000

The value is expected to increase by 5% each year.

Work out the expected value after 4 years.
Give your answer to 2 significant figures.
You **must** show your working.

Answer £ 150 000

**(Total 4 marks)**

Method 1:

$120 000 \times 0.05 = 6000$

after 1 year : £ 126 000

$126 000 \times 0.05 = 6300$

after 2 years : £ 132 300

$132 300 \times 0.05 = 6615$

after 3 years : 138 915

$138 915 \times 0.05 = 6945.75$

after 4 years : 145 860.75

Method 2:

$120 000 \times 1.05^4$

$= 145 860.75$

**Q10**

$y$ is inversely proportional to $x$.

Complete the table.

$$y \propto \frac{1}{x}$$

$$y = \frac{k}{x}$$

$$4 = \frac{k}{6}$$

$$\boxed{k = 24}$$

| $x$ | 12 | 6 | 3 |
|-----|----|----|----|
| $y$ | 2 | 4 | 8 |

$$8 = \frac{24}{x}$$

**(Total 2 marks)**

**Q6**

$$\begin{array}{cc} Z & F \\ 1.86 & : & 1.6 \end{array}$$

The height of Zak is 1.86 metres.

The height of Fred is 1.6 metres.

Write the height of Zak as a fraction of the height of Fred.

Give your answer in its simplest form.

**(Total 3 marks)**

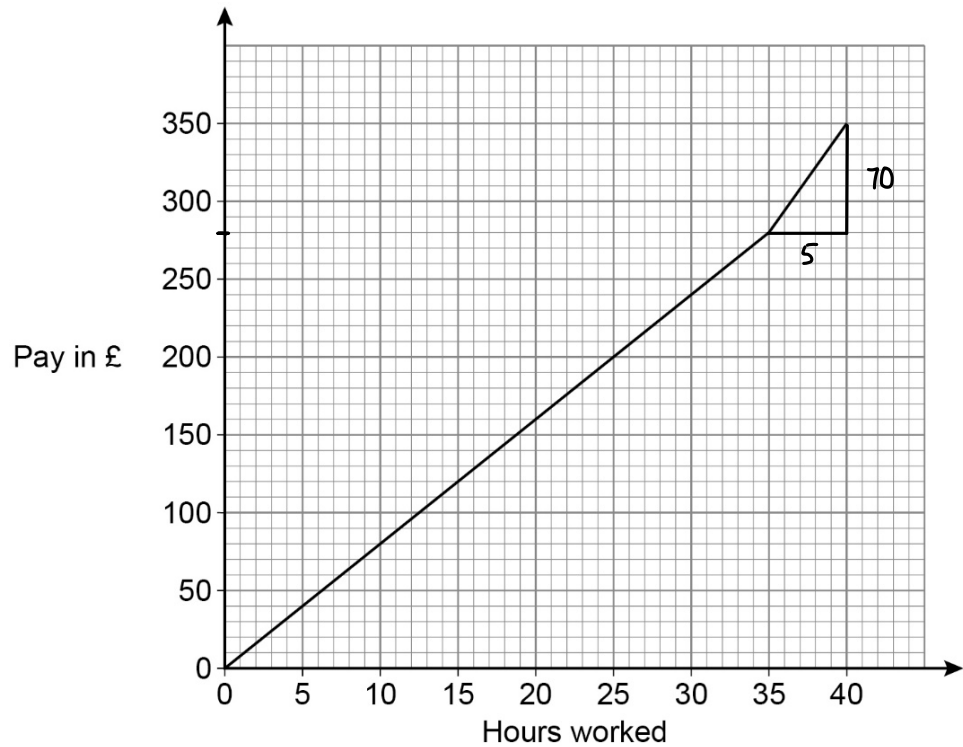$$\frac{Zak}{Fred} = \frac{1.86}{1.6} = \frac{186}{160} = \frac{93}{80}$$

**Q12**

The graph shows how much Molly is paid for working for up to 40 hours.

She receives

a basic rate of pay for the first 35 hours worked

a higher rate of pay for the next 5 hours worked.



Work out the difference between the higher rate of pay and the basic rate of pay.

Give your answer in £ per hour.

Answer £ _____ 6 _____ per hour

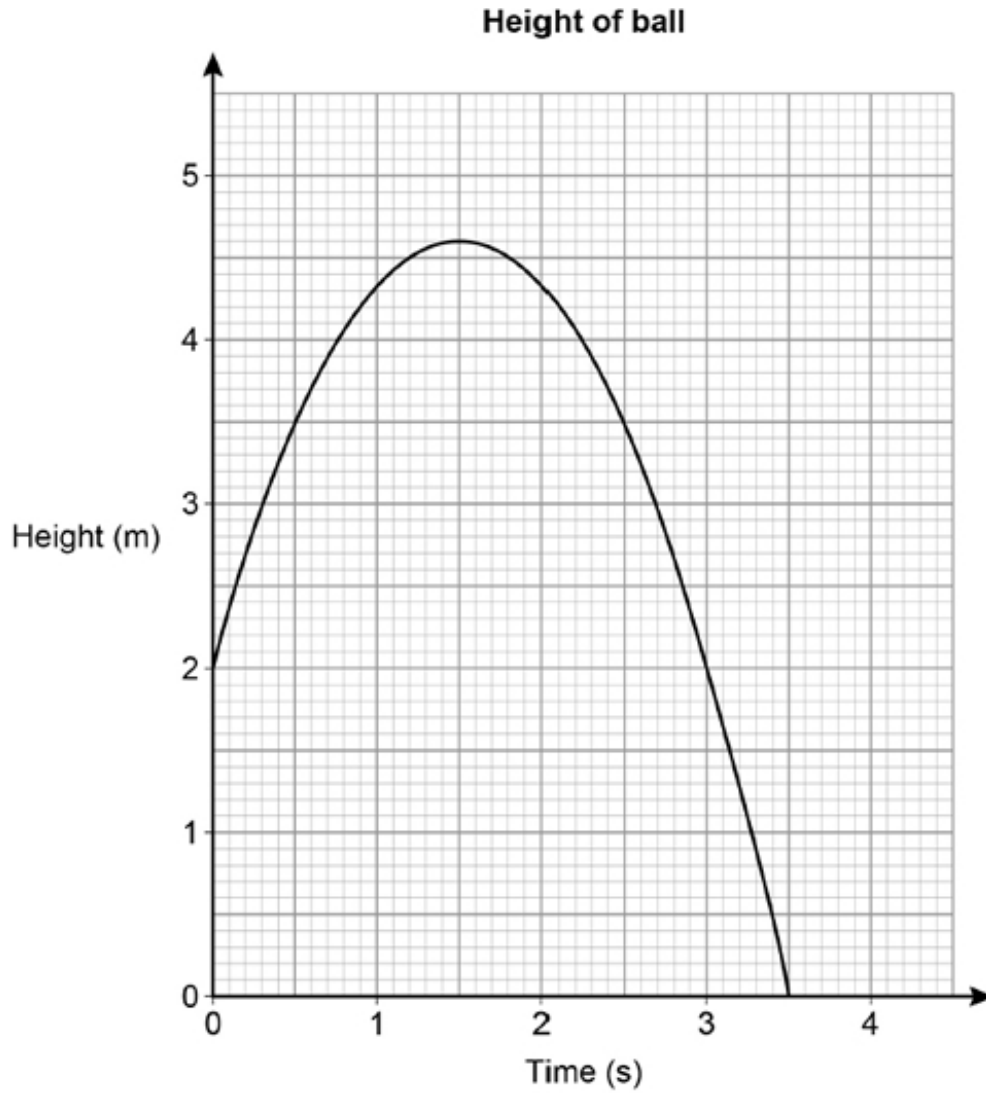**(Total  3 marks)**

basic rate of pay : $\frac{280}{35}$ = £8 per hour

14 − 8 = 6

higher rate of pay : $\frac{70}{5}$ = £14 per hour

**Q17b**

A ball is thrown vertically upwards.

The graph shows the height of the ball above the ground after it is thrown.

**Height of ball**



(b) After how many seconds is the ball at instantaneous rest when it is in the air?
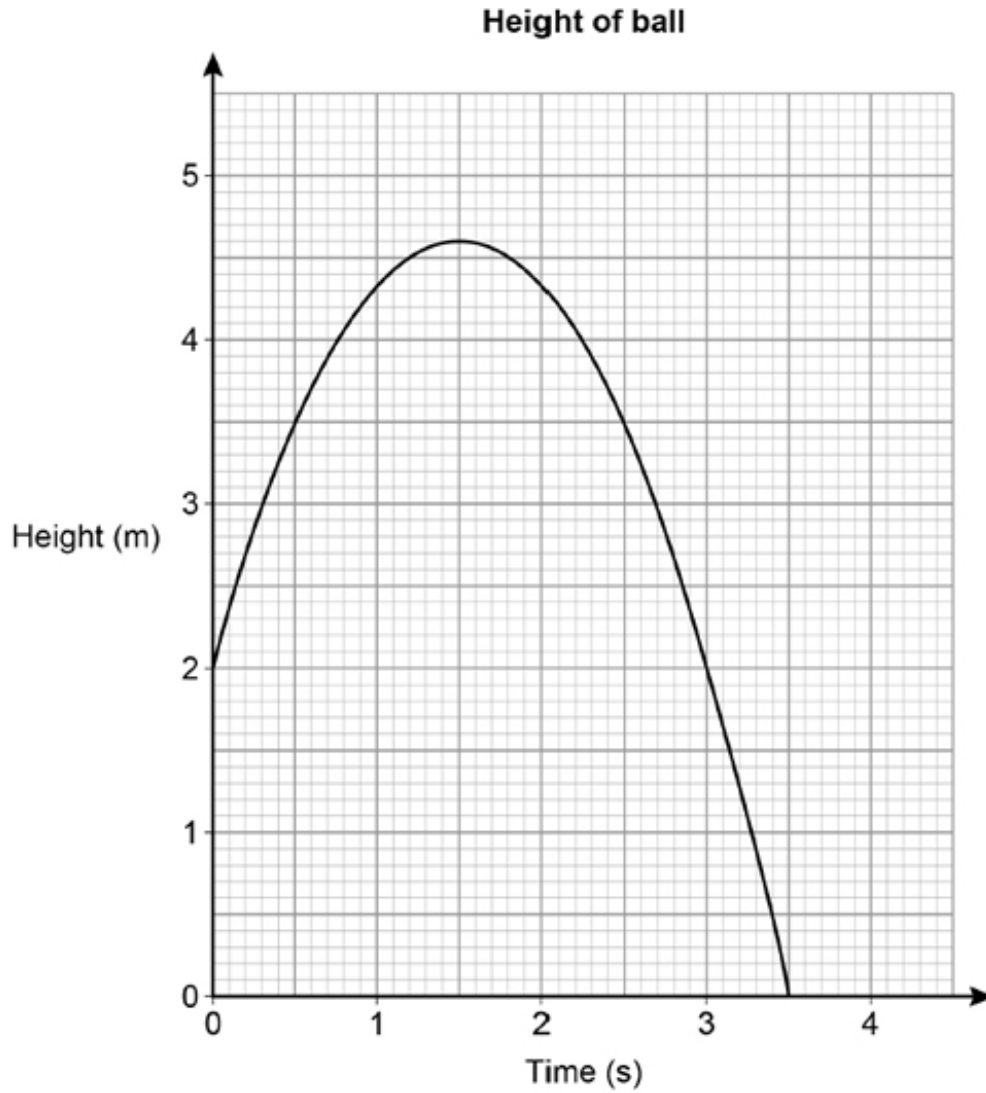
Answer _____1·5_____ s

**(Total 1 mark)**

**Q17c**

A ball is thrown vertically upwards.

The graph shows the height of the ball above the ground after it is thrown.

**Height of ball**



Height (m)

Time (s)

(c)   Work out the average speed of the ball when it is moving downwards.

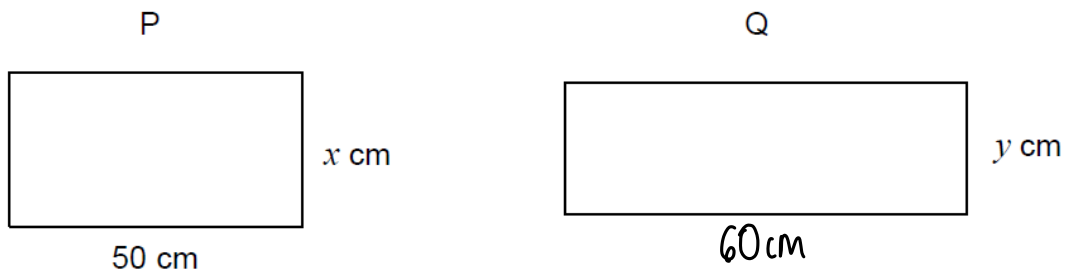Answer _____ 2.3 _____ m/s

**(Total 2 marks)**

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{4.6}{2} = 2.3 \text{ m/s}$$

## Q17

P is a rectangle with length 50 cm and width $x$ cm

Q is a rectangle with width $y$ cm

Not drawn
accurately

P

$x$ cm

50 cm

Q

$y$ cm

60cm

The length of Q is 20% **more** than the length of P.

The area of Q is 10% **less** than the area of P.

Work out the ratio $x : y$

Give your answer in its simplest form.

Answer _____4_____ : ____3_____

(Total 4 marks)

Area of Q = 60y

Area of P = 50x

area of Q = 10% lessthan P,

so 60y = 0.9 × 50x

⟹ 60y = 45x

⟹ $x : y$ = $\frac{60}{45}$ = 4 : 3

**Q23**

A shopkeeper compares the income from sales of a laptop in March and April.

**April**

| Price | $\frac{1}{5}$ more than March |
|---|---|
| Number sold | $\frac{1}{4}$ less than March |

$1 + \frac{1}{5} = \frac{6}{5}$

$1 - \frac{1}{4} = \frac{3}{4}$

By what fraction does the income from these sales decrease in April?

**(Total 3 marks)**

let M be the income from March

→ the income from April = $\frac{6}{5} \times \frac{3}{4} \times M = \frac{9}{10} M$ so income in April

decreased by 10%.

**Q2**

How many millimetres are there in a kilometre?

Circle your answer.

$MM \overset{\div 10}{\longrightarrow} CM \overset{\div 100}{\longrightarrow} M \overset{\div 1000}{\longrightarrow} km$

$10^3$ $10^5$ $10^6$ $10^9$

**(Total 1 mark)**

## Q21a

$y$ is inversely proportional to $\sqrt{x}$

$y = 4$ when $x = 9$

(a) Work out an equation connecting $y$ and $x$.

**(Total 3 marks)**

$$y = \frac{k}{\sqrt{x}}$$

$$\Rightarrow 4 = \frac{k}{\sqrt{9}}$$

$4 = \frac{k}{3} \Rightarrow 4 \times 3 = k \Rightarrow \underline{k = 12}$ which means the equation is $Y = \frac{12}{\sqrt{x}}$

## Q21b

$y$ is inversely proportional to $\sqrt{x}$

$y = 4$ when $x = 9$ $\Rightarrow Y = \frac{12}{\sqrt{x}}$ from part a.

(b) Work out the value of $y$ when $x = 25$

$Y = \frac{12}{\sqrt{x}} \Rightarrow y = \frac{12}{\sqrt{25}} = \frac{12}{5} = \underline{2.4}$

**(Total 2 marks)**

$x = 25$

## Q26

b is two thirds of $c$.

$5a = 4c \longrightarrow a = \frac{4}{5}c$

Work out the ratio $a : b : c$

Give your answer in its simplest form where $a$, $b$ and $c$ are integers.

$b = \frac{2}{3}c$

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

$$
\begin{array}{ccc}
a & : b & : C \\
1 & : \frac{5}{6} & : \frac{5}{4}
\end{array}
$$

$4 : \frac{20}{6} : 5$

$24 : 20 : 30$   $\div 2$

$= 12 : 10 : 15$

Answer ____12____ : ____10____ : ____15____

**(Total 3 marks)**