
MR TOMPKINS EDTECH

Maths and Edtech videos for students and teachers...

## GCSE Exam Questions Compilation

# Top 10 Topics for Paper 2

Complete the questions first, and then use the video to mark/uplevel your work in red pen. Video link: https://youtu.be/efx7ONeqtAA

***Suitable for Higher Tier Students***

- Repeated Percentage Change
- Construction and Loci
- Angles
- Pythagoras and Trigonometry
- Averages from a Frequency Table
- Complete the Square and Turning Points
- Cumulative Frequency
- Histogram
- Advanced Trigonometry
- Functions
- Straight Line Graphs

Thank you to Dawn Crichton @Spencer Academies Trust for compiling this worksheet

# Repeated Percentage Change

**Q1.** Daniel invests £2500 for 3 years.

The compound interest rate is 2.9% per year.

(a) Which calculation works out the total value after 3 years? Circle your answer.

£2500 × 1.029 × 3 £2500 × 2.9 × 3

£2500 × $2.9^3$ £2500 × $1.029^3$

**(1)**

(b) Anna invests £2500 for 3 years.

The interest rate is

3.5% for the first year

2.3% for the second year onwards.

Whose investment is worth more after 3 years?

You **must** show your working.

_____

_____

_____

_____

Answer _____ **(4)**

**(Total 5 marks)**

**Q2.** A marathon takes place each year. In 2020 there were 6500 runners.

| **Prediction** |
| --- |
| For each of the next 3 years the number of runners will increase by 5% |

Does this predict that in 2023 there will be more than 7500 runners?

You **must** show your working.

_____

_____

_____

_____

**(Total 3 marks)**

**Q3.** The population of butterflies in a park is 4200

(a) Assume that the population increases by 12% each day.

Show that after 20 days the population would be greater than 40 000

_____

_____

_____

_____ **(2)**

(b) In fact, the population

increases by 13% each day for 19 days

then

**decreases** by 8% for 1 day.

After the 20 days, is the actual population greater than 40 000 ? Tick a box.

☐ Yes ☐ No

Show working to support your answer.

_____

_____

_____

_____ **(2)**

**(Total 4 marks)**

**Q4.** The value of a second-hand car is £9000

Each year it loses 20% of its value at the start of that year.

Work out its value in four years time.

_____

_____

_____

_____

_____

_____

Answer £ _____

**(Total 3 marks)**

**Q5.** The number of hedgehogs in England is expected to **reduce** by 4% each year.
Assume there are now 1 000 000 hedgehogs in England.

Work out the expected number of hedgehogs in England after **five** years.
You **must** show your working.

Answer _____

**(Total 3 marks)**

**Q6.** £2448 is invested in an account at a rate of compound interest.
One year after the investment there is £2496.96 in the account.

How much is in the account four years after the investment?

Answer £ _____

**(Total 3 marks)**

## Construction and Loci

**Q7.** Use ruler and compasses for this question.

A wind turbine needs to be positioned

closer to port *X* than port *Y*

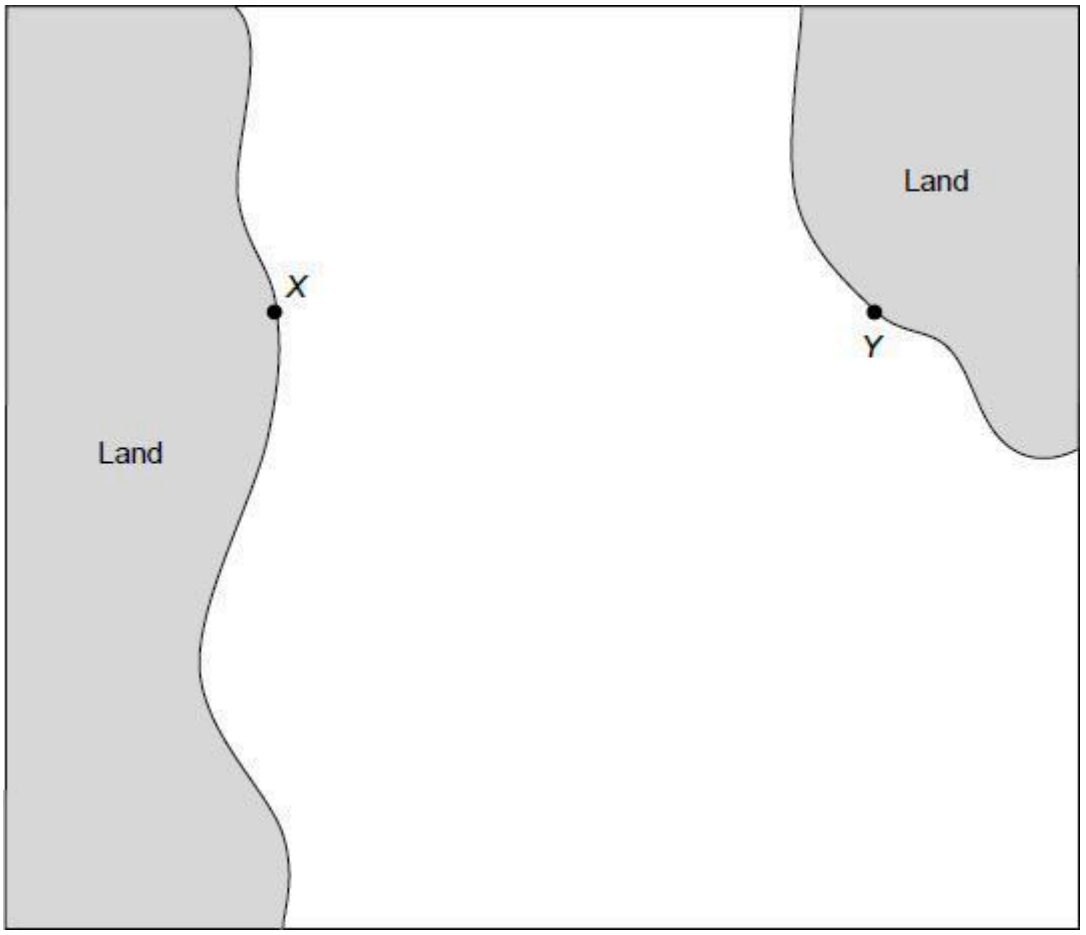
less than 11 km from *Y*.

The map below shows the positions of *X* and *Y*.

On the map, show the region where the wind turbine could be positioned.

Label it *R*.

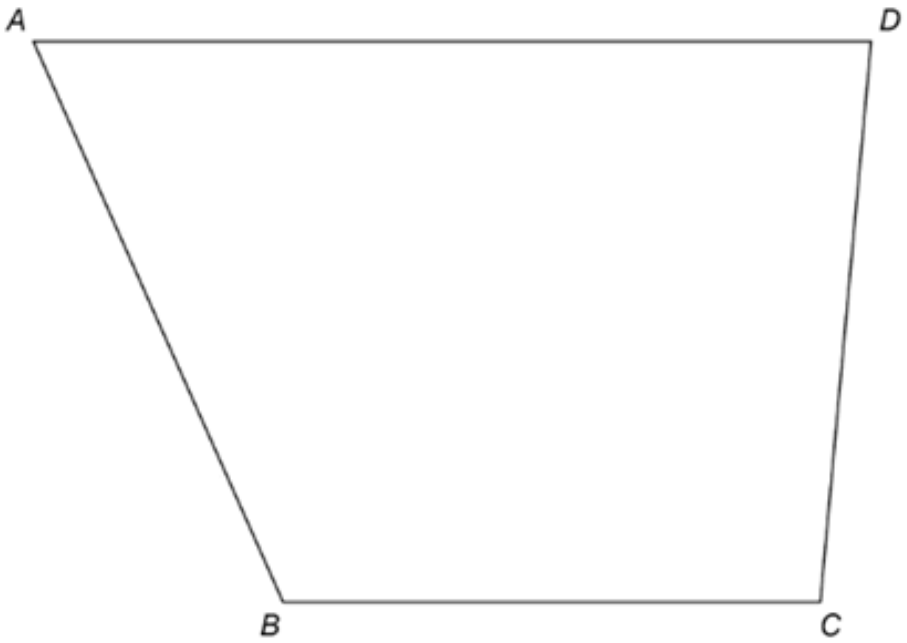
**Scale** 1 cm represents 2 km




**(Total 4 marks)**

**Q8.** Use ruler and compasses to answer this question.

*ABCD* represents a garden.




A tree is to be planted in the garden.

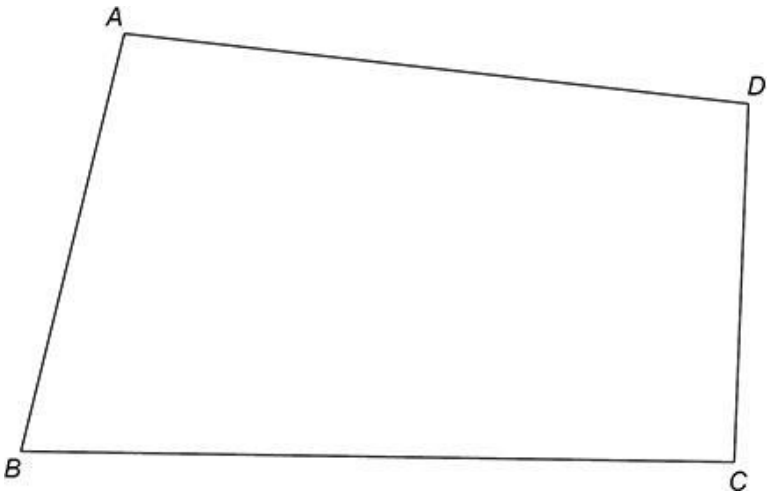
The tree will be in the region that is closer to *AB* than to *BC*.

Label the region, R, where the tree could be planted.

Show all your construction lines.

**[3 marks]**

**Q9.** *ABCD* represents the plan of a field.




There is a path across the field that

starts at *B*

is the same distance from *BA* and *BC*.

Using ruler and compasses, show the position of the path. **(Total 2 marks)**

# Angles

**Q10.** Part of a regular polygon with 15 sides is shown.

Not drawn accurately

Work out the size of an **interior** angle.

_____

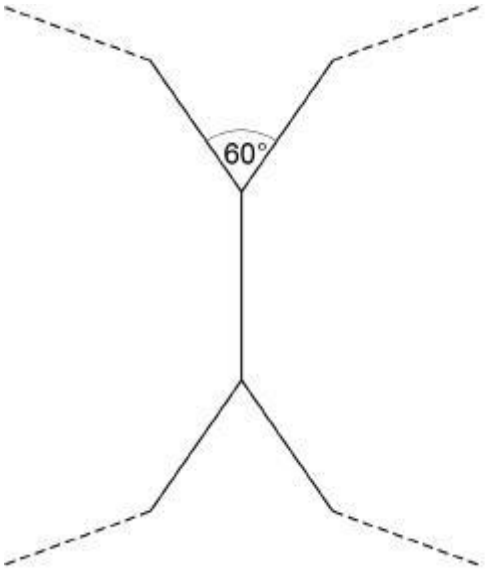
_____

_____

Answer _____ degrees

**(Total 2 marks)**

**Q11.** Two congruent regular polygons are joined together.




Not drawn accurately

Work out the number of sides on each polygon.

_____

_____

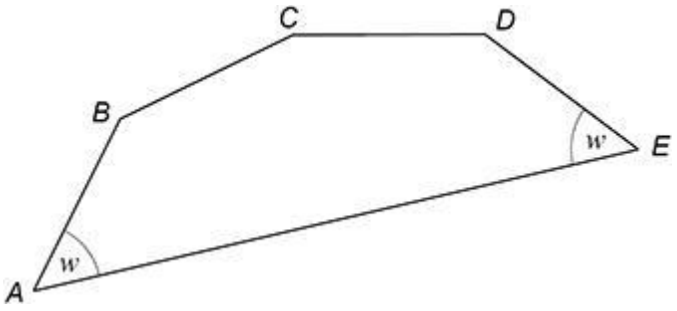
_____

_____

Answer _____

**(Total 3 marks)**

**Q12.** *AB*, *BC*, *CD* and *DE* are four of the sides of a regular decagon.




Not drawn accurately

Work out the size of angle $w$.

_____

_____

_____

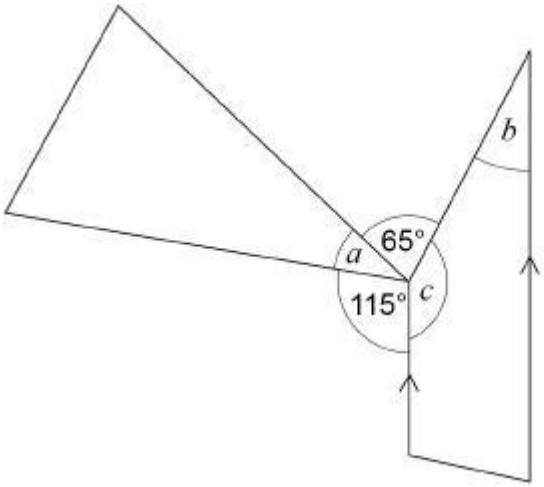
_____

_____

Answer _____ degrees

**(Total 3 marks)**

**Q13.** The diagram shows a triangle and a trapezium.




Not drawn accurately

Prove that $a = b$

_____

_____

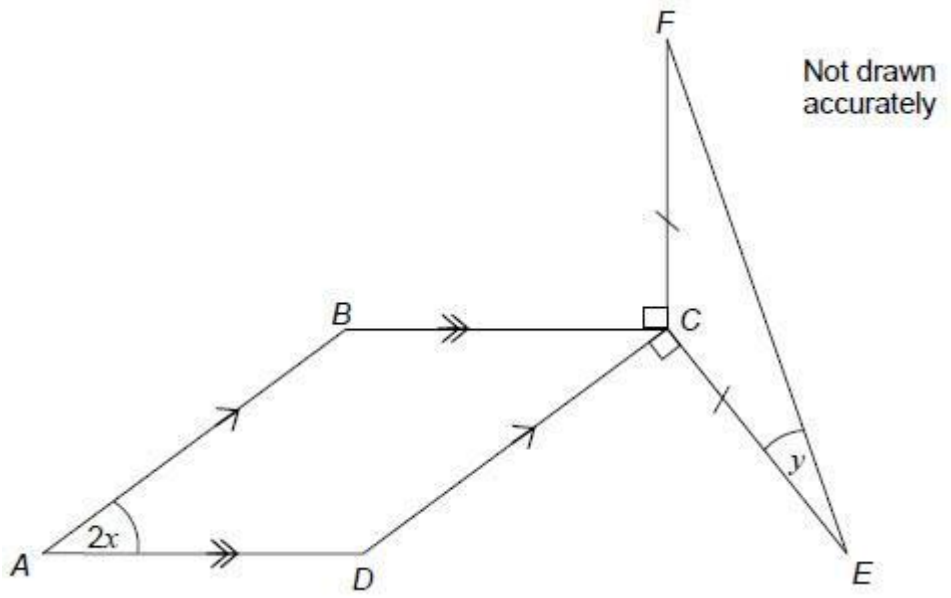
_____

_____

**(Total 3 marks)**

**Q14.** *ABCD* is a parallelogram.

*CE* = *CF*



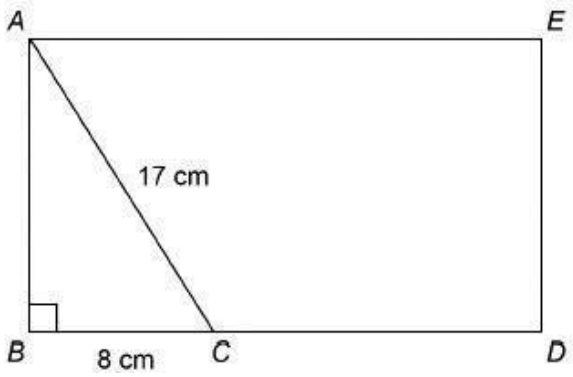

Prove that $y = x$

**(Total 5 marks)**

# Pythagoras and Trigonometry

**Q15.** The diagram shows rectangle *ABDE* and right-angled triangle *ABC*.

*AC* = 17 cm  *BC* = 8 cm  Not drawn accurately




*BC* : *CD* = 1 : 2

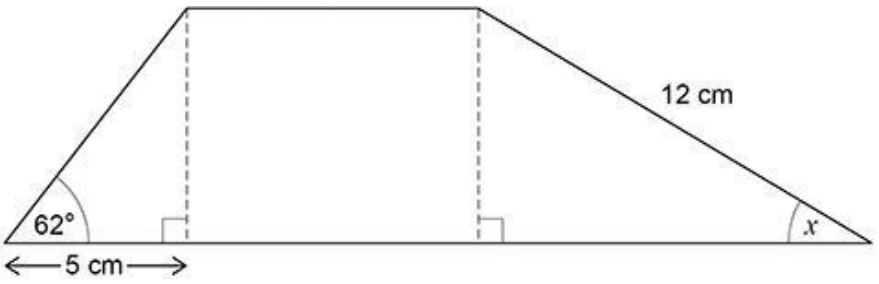
Work out the area of rectangle *ABDE*.

Answer _____ cm$^2$

**(Total 4 marks)**

**Q16.** This shape is made from two right-angled triangles and a rectangle.

Not drawn accurately

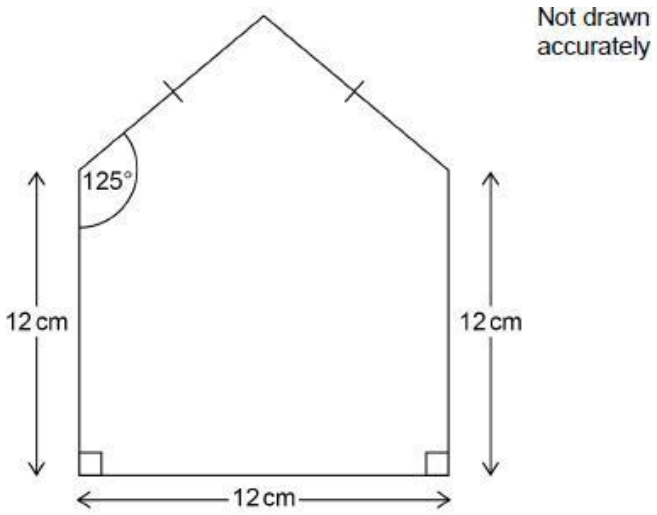



Work out the size of angle $x$.

Answer _____ degrees

**(Total 4 marks)**

**Q17.** A pentagon is made from a square and an isosceles triangle.

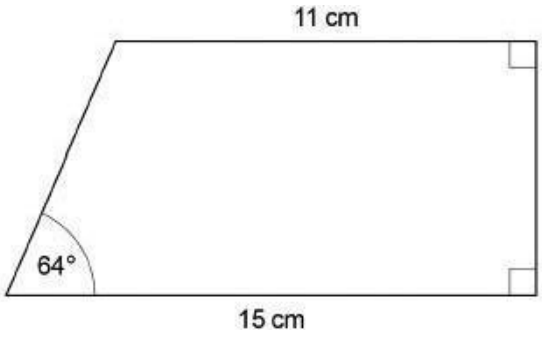



Work out the perimeter of the pentagon.

Answer _____ cm

**(Total 4 marks)**

**Q18.** Work out the area of the trapezium. Not drawn accurately



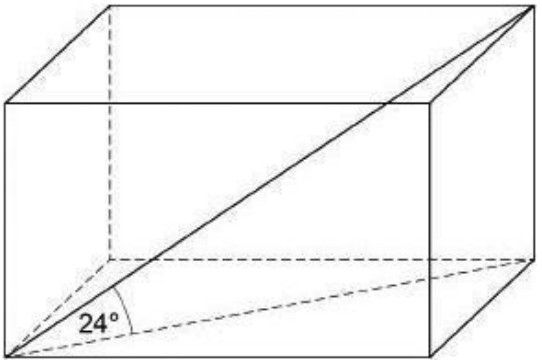

Answer _____ $cm^2$

**(Total 4 marks)**

**Q19.** The length of a diagonal of a cuboid is 20 cm

The diagonal makes an angle of 24° with the base.

The area of the base is 150 $cm^2$




Work out the volume of the cuboid.

_____

_____

_____

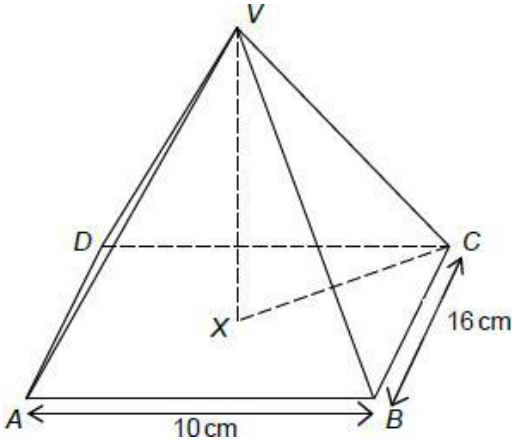
Answer _____ $cm^3$

**(Total 3 marks)**

**Q20.** Volume of a pyramid = $\frac{1}{3}$ × area of base × perpendicular height

*VABCD* is a rectangular-based pyramid with volume 640 $cm^3$

*X* is the centre of the horizontal base, directly below *V*.




Work out the angle between *VC* and the base.

_____

_____

_____

_____

Answer _____ degrees

**(Total 6 marks)**

# Averages from a Frequency Table

**Q21.** Here is some information about the times taken by 40 people to fill in a form.

| Time, $t$ minutes | Number of people |
|---|---|
| $0 < t \leq 5$ | 3 |
| $5 < t \leq 10$ | 9 |
| $10 < t \leq 15$ | 11 |
| $15 < t \leq 20$ | 17 |

In which class interval is the median?
Circle your answer.

$0 < t \leq 5$ $5 < t \leq 10$ $10 < t \leq 15$ $15 < t \leq 20$

**(Total 1 mark)**

**Q22.** Here is a frequency table for the times taken to solve a puzzle.

| Times, $t$ (min) | Frequency |
|---|---|
| $0 < t \leq 1$ | 38 |
| $1 < t \leq 2$ | 16 |
| $2 < t \leq 3$ | 17 |
| $3 < t \leq 4$ | 15 |
| $4 < t \leq 5$ | 14 |
| | Total = 100 |

Which class interval contains the median?

_____

_____

Answer _____

**(Total 2 marks)**

**Q23.** The table shows information about the distances walked by 120 students on their way to school one week.

| **Distance, $x$ (miles)** | **Frequency** | | |
|---|---|---|---|
| $0 < x \leq 5$ | 20 | | |
| $5 < x \leq 10$ | 48 | | |
| $10 < x \leq 15$ | 30 | | |
| $15 < x \leq 20$ | 22 | | |
| | Total = 120 | | |

Work out an estimate for the mean distance.

Answer _____ miles

**(Total 3 marks)**

**Q24.** An athlete runs in 10 000 metre races.
The table shows the times for his last 20 races.

| **Time, $t$ (minutes)** | **Frequency** | | |
|---|---|---|---|
| $30 < t \leq 32$ | 3 | | |
| $32 < t \leq 34$ | 9 | | |
| $34 < t \leq 36$ | 6 | | |
| $36 < t \leq 38$ | 2 | | |

Calculate an estimate of his mean time.

Answer _____ minutes

**(Total 4 marks)**

**Q25.** The amounts spent on clothes by 40 boys and 40 girls in one month were recorded.

The table shows information about the amounts spent by the boys.

| **Amount, $x$ (£)** | **Midpoint** | **Number of boys** | |
|---|---|---|---|
| $0 \leq x < 20$ | | 22 | |
| $20 \leq x < 40$ | | 9 | |
| $40 \leq x < 60$ | | 6 | |
| $60 \leq x < 80$ | | 3 | |
| | | Total = 40 | |

The mean for the girls was £35

Estimate the mean for the girls as a percentage of the mean for the boys.

Answer _____ %

**(Total 5 marks)**

## Complete the Square and Turning Points

**Q26.** Express $x^2 - 6x - 15$ in the form $(x - a)^2 - b$ where $a$ and $b$ are integers.

Answer _____

**(Total 2 marks)**

**Q27.** (a) Write $x^2 + 10x + 28$ in the form $(x + a)^2 + b$

Answer _____ **(2)**

(b) Hence, write down the coordinates of the turning point of the curve $y = x^2 + 10x + 28$

Answer ( _____ , _____ ) **(1)**

**(Total 3 marks)**

**Q28.** The equation of a curve is $y = x^2 - 18x + 70$

By completing the square, work out the coordinates of the turning point.

You **must** show your working.

Answer ( _____ , _____ )

**(Total 3 marks)**

**Q29.** (a) Write $x^2 + 6x + 10$ in the form $(x + a)^2 + b$

Answer _____ **(2)**

(b) Hence, write down the coordinates of the turning point of the curve $y = x^2 + 6x + 10$

Answer (..... , .....) **(1)**

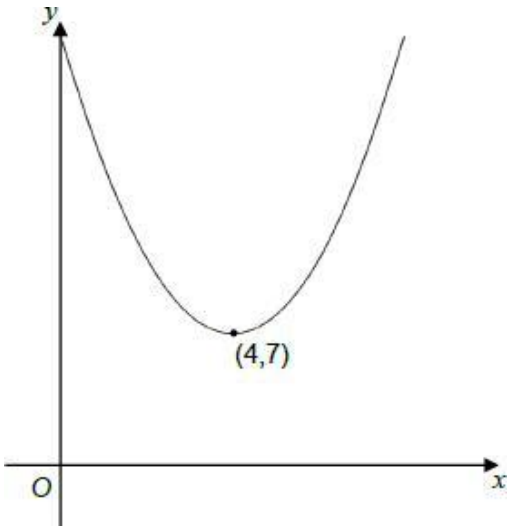
**(Total 3 marks)**

**Q30.** (a) Write $x^2 + 8x + 6$ in the form $(x + a)^2 + b$

Answer _____ **(2)**

(b) A sketch of $y = x^2 + cx + d$ is shown.

The turning point is (4, 7) Not drawn accurately




Work out the values of $c$ and $d$.

$c$ = _____ $d$ = _____ **(3)**

**(Total 5 marks)**

**Q31.** (a) Show that $x^2 - 8x + 20$

can be written in the form $(x - a)^2 + a$

where $a$ is an integer.

_____

_____

_____

_____

_____

_____

**(3)**

(b) Hence explain how you know that $x^2 - 8x + 20$ is always positive.

_____

_____

_____

**(2)**

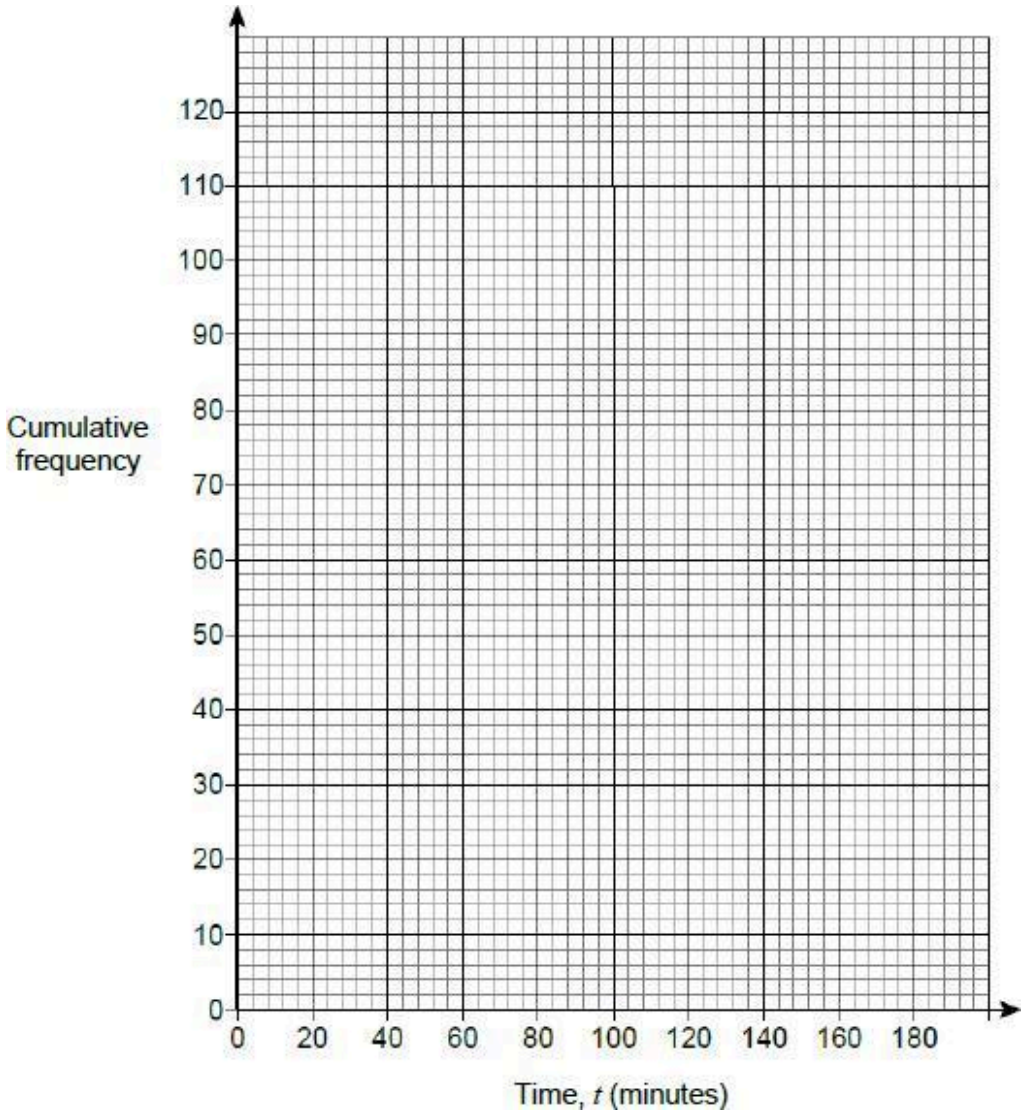
**(Total 5 marks)**

# Cumulative Frequency

**Q32.** The table shows the running times of some films.

| Time, $t$ (minutes) | Number of films |
|---|---|
| $0 \leq t < 80$ | 0 |
| $80 \leq t < 100$ | 12 |
| $100 \leq t < 120$ | 38 |
| $120 \leq t < 140$ | 36 |
| $140 \leq t < 160$ | 24 |
| $160 \leq t < 180$ | 10 |

(a) Draw a cumulative frequency graph on the grid below to represent the data.




**(3)**

(b) Estimate the number of these films with a running time of less than 130 minutes.

Answer _____ **(1)**

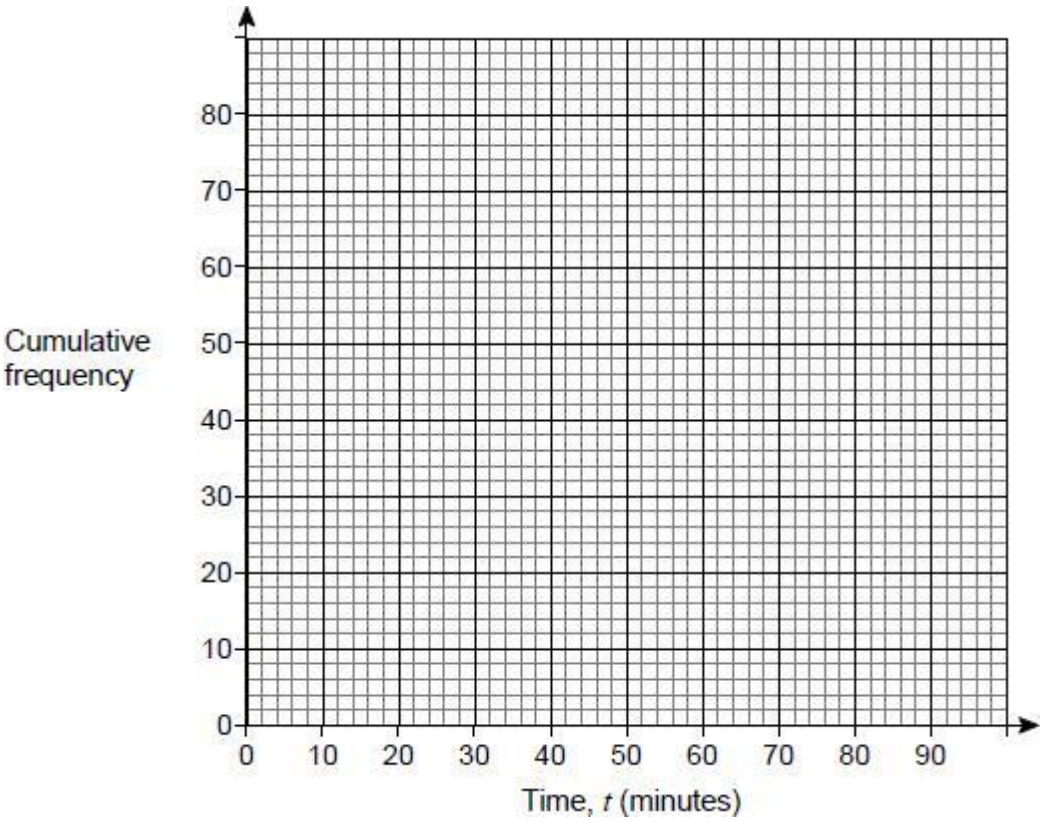
**(Total 4 marks)**

**Q33.** Here is some information about the times, in minutes, 80 teachers took to get to work.

| Time $t$ (minutes) | Frequency |
|---|---|
| $0 < t \leq 20$ | 21 |
| $20 < t \leq 40$ | 30 |
| $40 < t \leq 60$ | 19 |
| $60 < t \leq 90$ | 10 |

| | |
|---|---|
| | |
| | |
| | |
| | |

(a) On the grid, draw a cumulative frequency graph.




**(3)**

(b) Estimate the percentage of teachers who took over 45 minutes to travel to work.

Answer _____ %

**(2)**

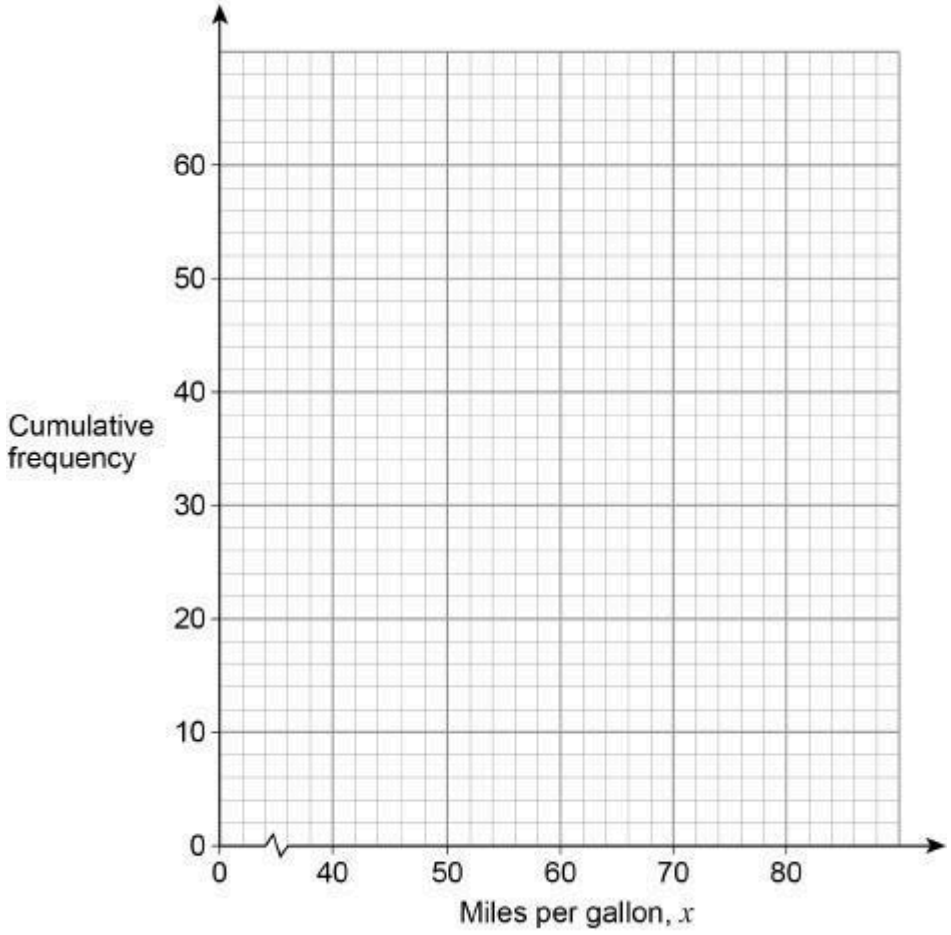
**(Total 5 marks)**

**Q34** Here is some information about the miles per gallon of 60 cars.

| Miles per gallon, $x$ | Frequency |
|---|---|
| $40 < x \leq 50$ | 6 |
| $50 < x \leq 60$ | 16 |
| $60 < x \leq 70$ | 28 |
| $70 < x \leq 80$ | 10 |

| | |
|---|---|
| | |
| | |
| | |
| | |

(a) Draw a cumulative frequency graph.




**(3)**

(b) Use the graph to work out the interquartile range.

_____

_____

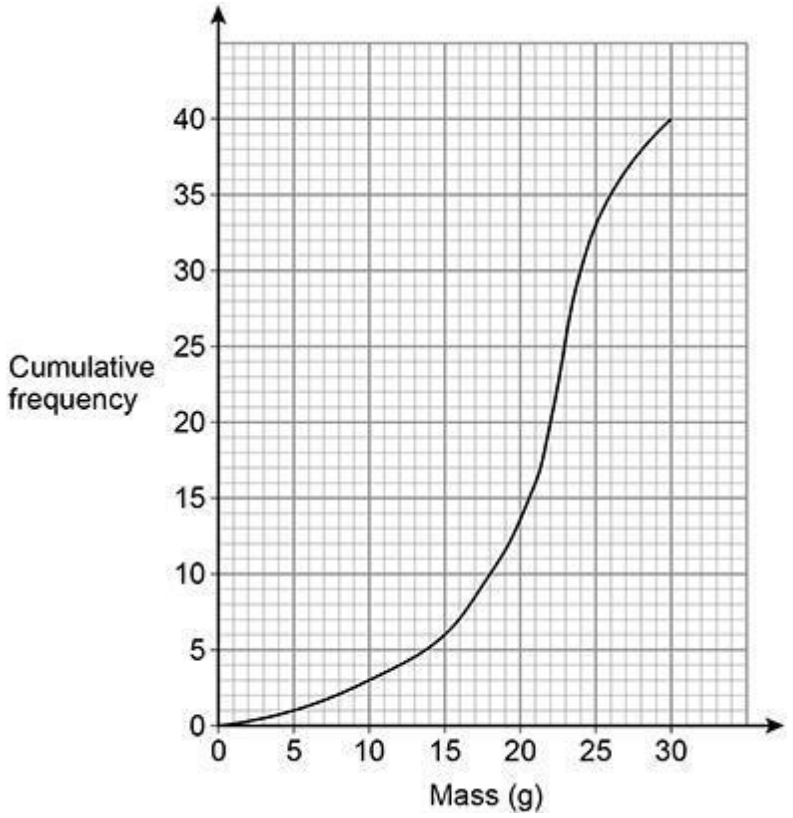
_____

Answer _____ miles per gallon

**(2)**

**(Total 5 marks)**

**Q35.** The cumulative frequency graph represents the masses of 40 necklaces.




(a) A jeweller buys every necklace with mass **greater than** 21 grams.

Use the graph to estimate how many she buys.

_____

_____

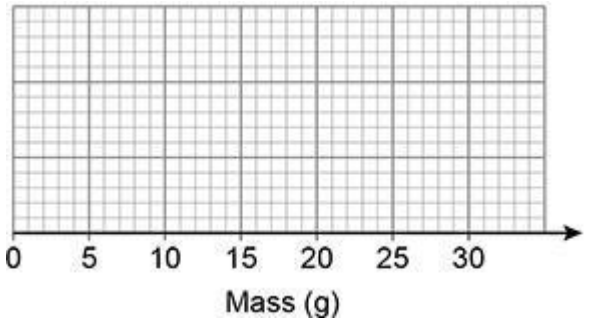
_____

Answer _____

**(2)**

(b) The lowest mass was 3 grams.
The highest mass was 28 grams.

Draw a box plot to represent the data.

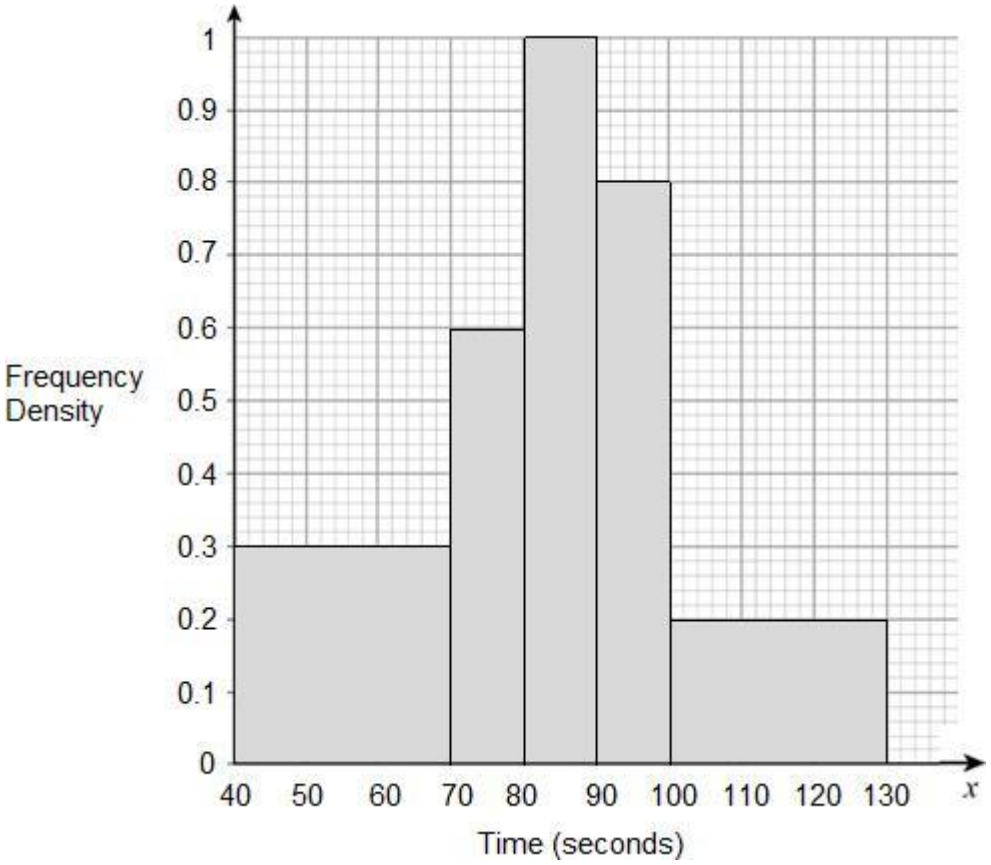



**(3)**

**(Total 5 marks)**

# Histograms

**Q36.** The histogram shows information about the times some children took to complete a puzzle.




Estimate the number of students who took less than 85 seconds to complete the puzzle.

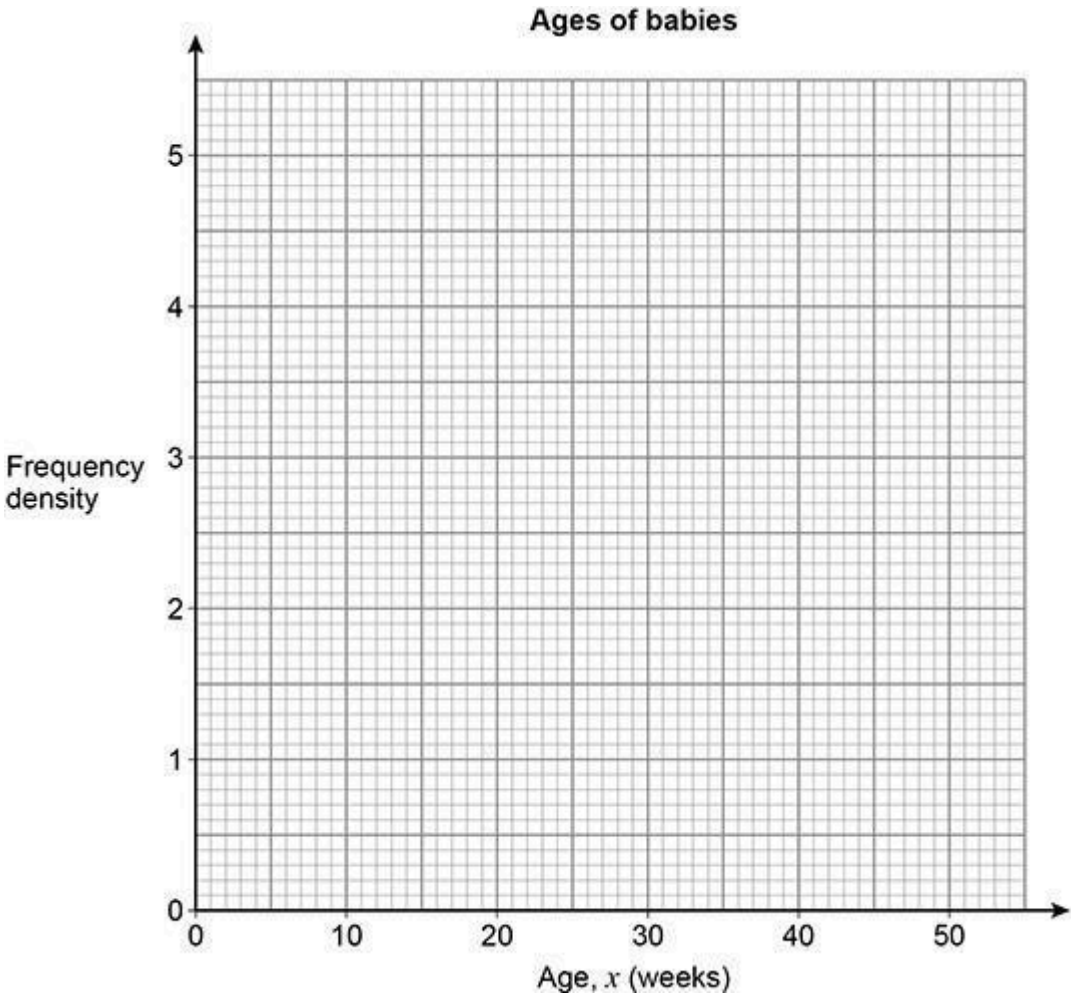
Answer _____

**(Total 3 marks)**

**Q37.** Here is some information about the ages of babies at a clinic.

| Age, $x$ (weeks) | Frequency | | |
|---|---|---|---|
| $0 \leq x < 5$ | 18 | | |
| $5 \leq x < 10$ | 23 | | |
| $10 \leq x < 20$ | 17 | | |
| $20 \leq x < 50$ | 21 | | |

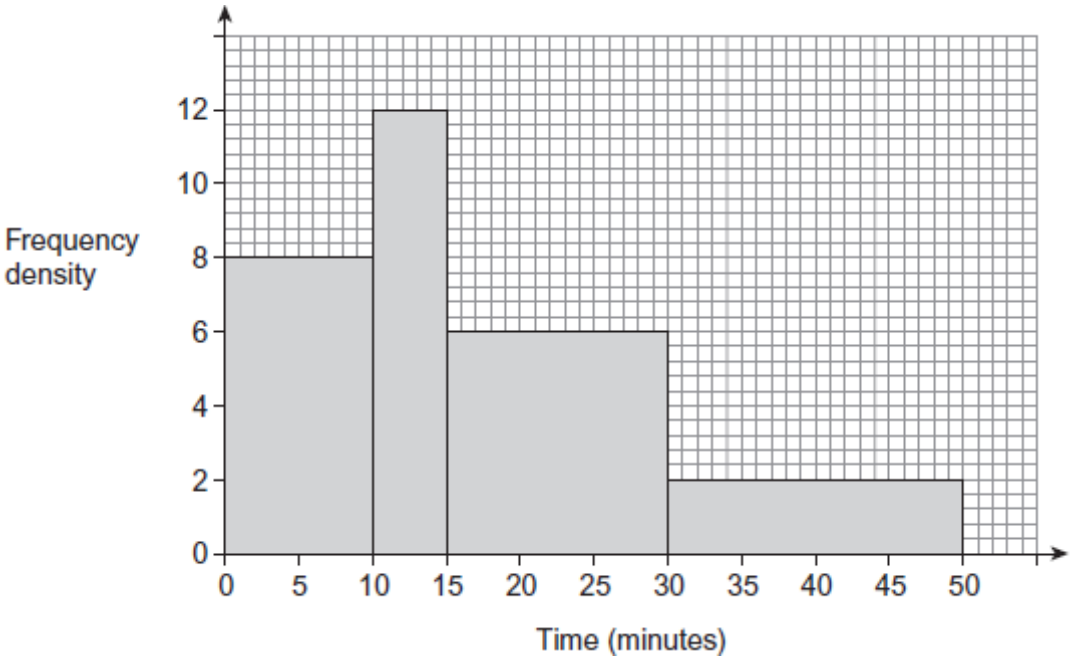
Draw a histogram to represent the information.




**(Total 4 marks)**

**Q38.** The histogram shows the time it takes 270 students to travel to school.

**Travel to school**




Kirsty says 30% of the students take more than 25 minutes to travel to school.

Is she correct?
Use the histogram to decide.
You **must** show your working.

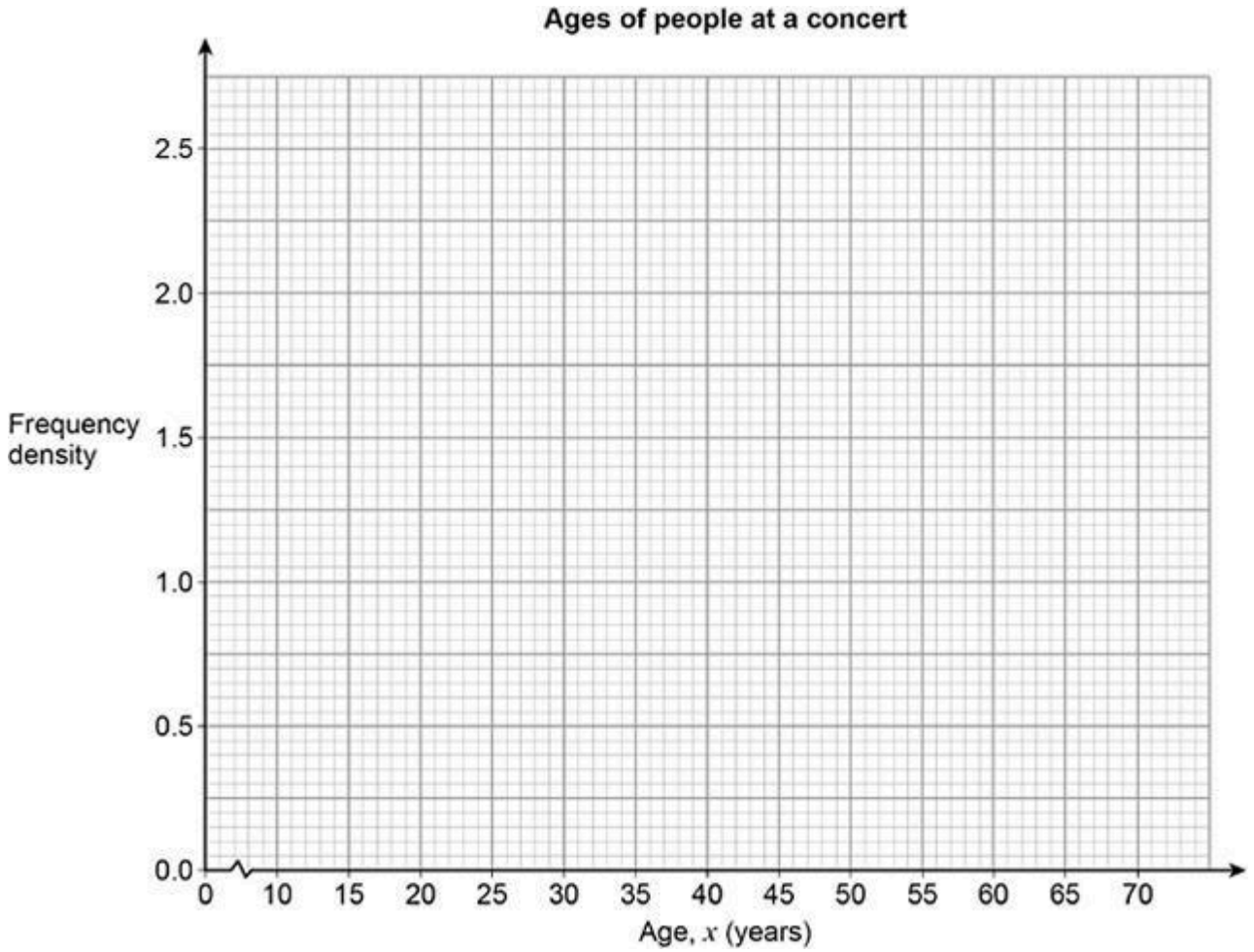
Answer _____

**(Total 5 marks)**

**Q39.** Here is some information about the ages of people at a concert.

| Age, $x$ (years) | Frequency |
|---|---|
| $10 \leq x < 15$ | 8 |
| $15 \leq x < 25$ | 24 |
| $25 \leq x < 40$ | 30 |
| $40 \leq x < 70$ | 39 |

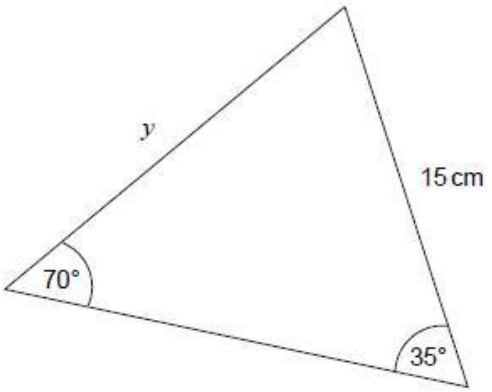
Draw a histogram to represent the information.




**(Total 3 marks)**

# Advanced Trigonometry

**Q40.** Work out the value of $y$.



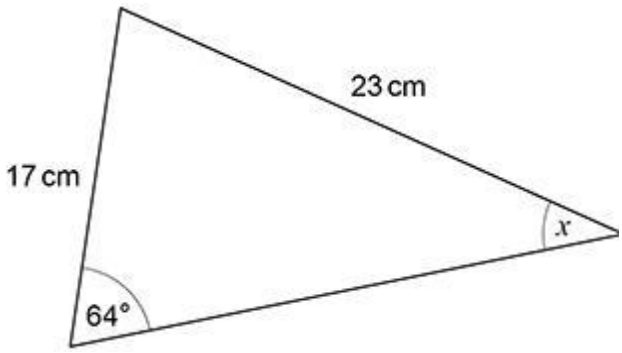

Not drawn accurately

Work out the value of $y$.

Answer _____ cm

**(Total 2 marks)**

**Q41.** Use the sine rule to work out the size of angle $x$.

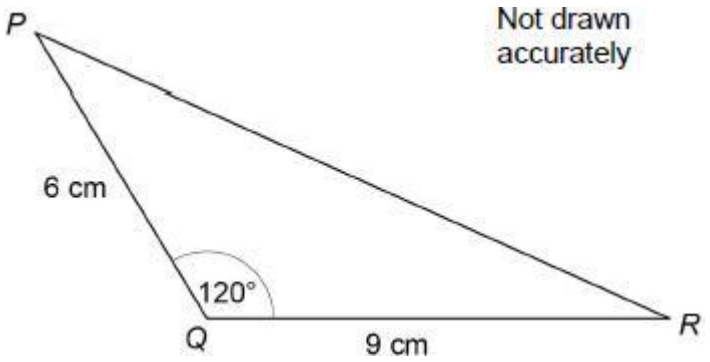



Not drawn accurately

$x$ = _____ °

**(Total 3 marks)**

**Q42.** Here is a triangle.

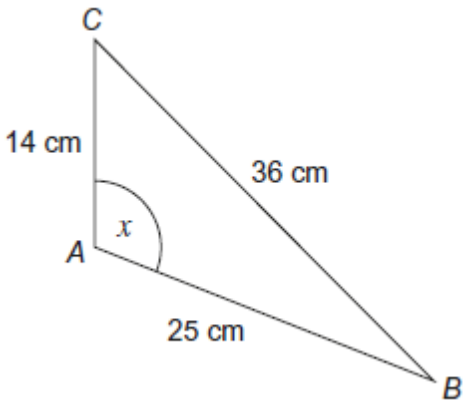



Work out the length *PR*.

Answer _____ cm

**(Total 3 marks)**

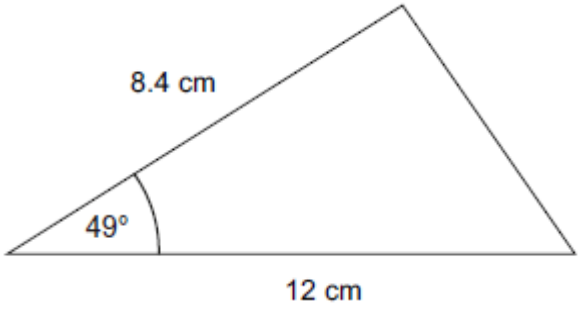
**Q43.** Work out the size of angle $x$. Not drawn accurately




Answer _____ degrees

**(Total 3 marks)**

**Q44.** Work out the area of the triangle. Not drawn accurately

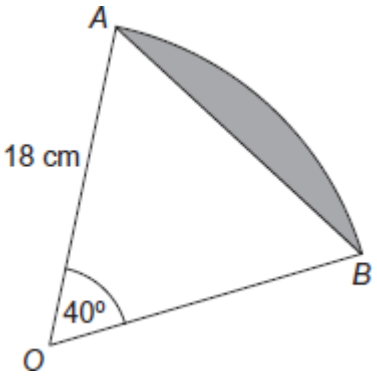



Answer _____ $cm^2$

**(Total 2 marks)**

**Q45.** The diagram shows a sector of a circle, centre *O*, radius 18 cm

Not drawn accurately




Work out the area of the shaded segment.

Answer _____ $cm^2$

**(Total 3 marks)**

# Straight Line Graphs

**Q46.** Work out the gradient of the straight line $y - 3x + 1 = 0$

Answer _____

**(Total 2 marks)**

**Q47.** Work out the equation of the line that

is parallel to the line $y = 4x - 1$

passes through $(-1, 1)$

Answer _____

**(Total 3 marks)**

**Q48.** Line A has equation $y = 4x - 1$

Line B is

perpendicular to line A and

passes through the point (8, 5)

Work out the coordinates of the point where line B intersects the $x$-axis.

Answer ( _____ , _____ )

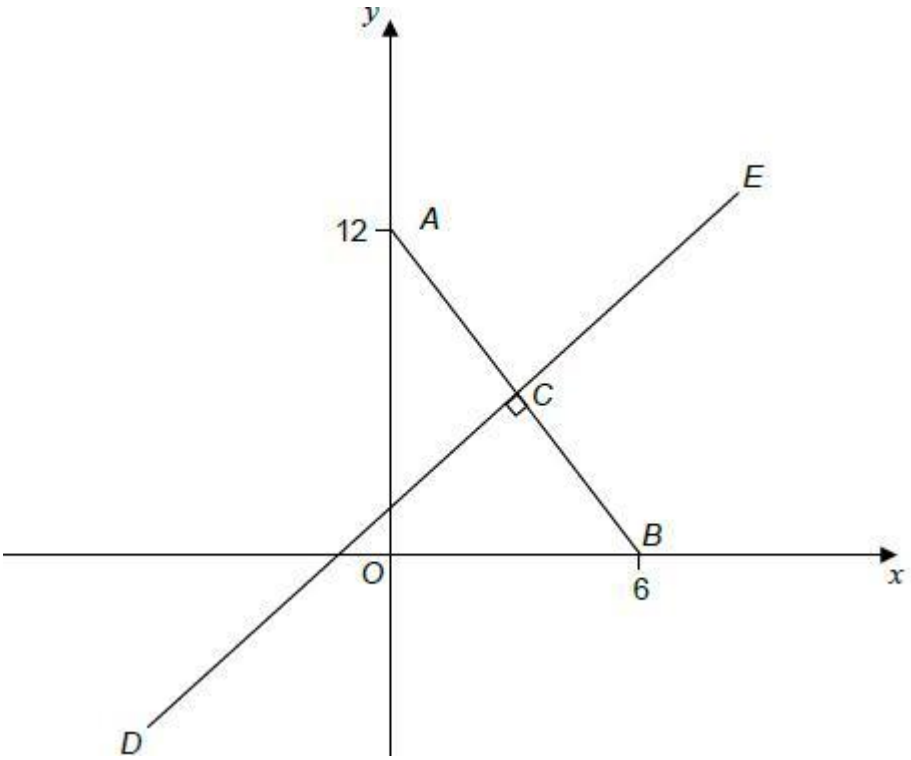
**(Total 4 marks)**

**Q49.** *ACB* is a straight line.

*A* is the point (0, 12), and *B* is the point (6, 0)

*C* is the midpoint of *AB.*

Line *DCE* is perpendicular to line *ACB.*




Not drawn accurately

Work out the equation of line *DCE*.

Answer _____

**(Total 5 marks)**

# Functions

**Q50.** f($x$) = 8$x$ − 5

Work out the value of f(−2)

_____

Answer _____

**(Total 1 mark)**

**Q51.** For all values of $x$, f($x$) = $\frac{9x+4}{7}$

Work out f$^{-1}$($x$)

_____

_____

_____

Answer _____

**(Total 3 marks)**

**Q52.** f($x$) = $\frac{3x+9}{5}$ and g($x$) = 6$x$ – 1

(a) Show that gf(2) is an integer.

_____

_____

_____

_____

_____

(b) Show that f$^{-1}$(8) is **not** an integer.

_____

_____

_____

_____

_____

_____ **(2)**

**(Total 4 marks)**

**Q53.** $f(x) = 2x + 5$

Show that $3f(x) - 12f^{-1}(x)$ simplifies to an integer.

_____

_____

_____

_____

_____

_____

_____

_____

**(Total 4 marks)**

**Q54.** $f(x) = 2x^2$ $g(x) = x + 5$

Work out the composite function $fg(x)$

Write your answer in the form $ax^2 + bx + c$ where $a$, $b$ and $c$ are integers to be found.

_____

_____

_____

_____

Answer _____

**(Total 2 marks)**

**Q55.** $g(x) = 16 - x$ $h(x) = x^3$

Solve $gh(x) = 24$

_____

_____

_____

_____

_____

$x$ = _____

**(Total 3 marks)**

**Q56.** $f(x) = 2x - 3$ and $g(x) = x^2$

Show that $f^{-1}(55) = fg(4)$

**(Total 4 marks)**

**Q57.** $f(x) = 5 - x$ and $g(x) = 3x + 7$

(a) Simplify $f(2x) + g(x - 1)$

Answer **(3)**

(b) Solve $g^{-1}(x) = 2x$

**(3)**

**(Total 6 marks)**