A Level Mathematics Year 12 Transition Work

Name:

A Level Mathematics builds upon the knowledge and skills you developed at GCSE. Throughout the course, you will be expected to apply mathematics confidently and independently, often in more challenging and unfamiliar situations. One of the biggest differences between GCSE and A Level is the expectation that you take ownership of your learning and identify areas where you need to improve. To start this process, we are asking you to complete a subject knowledge audit of key GCSE topics that are essential for success in Year 12.

For each topic area, there are a few questions. Try them and check your answers at the end of the booklet. After attempting the questions, reflect honestly on your confidence in each topic using the subject knowledge audit grid below.

There are no prizes for saying you are confident in everything. The purpose of this booklet is to help you identify your strengths and, more importantly, the areas where you would benefit from additional practice. The results of your self-assessment grid will be used in the first weeks of the course, but this is not a test, and your maths will not be marked. Developing the habit of recognising what you need to improve and then taking steps to improve it is one of the most important skills you will develop during your A Level studies.

You only need to bring this first page, with a completed grid, to your first A Level Mathematics lesson.

Tick one box per row after completing the questions for each topic area.

Topic	Very confident	Mostly confident	Need more practice	Need significant practice
Surds				
Indices				
Venn diagrams				
Histograms				
Statistical measures				
Velocity-time graphs				
Circle theorems				
Coordinate geometry				
Vector geometry				

Surds (Non-calculator)

- Attempt each question
- Check answers at the end of the booklet
- Reflect honestly on how confident you feel on this topic
- Fill in reflection grid on Page 1

Q1

Write $8 : \left(3\sqrt{2}+\sqrt{50}\right)^2$ in the form $1 : n$ where n is an integer.

Q2

Work out $\sqrt{2\frac{13}{16}} - \frac{2}{\sqrt{5}}$

Give your answer in the form $\frac{a\sqrt{5}}{b}$ where a and b are integers.

Q3

Rationalise the denominator and simplify fully

$$\frac{1+\sqrt{5}}{3-\sqrt{5}}$$

Indices (Non-calculator)

- Attempt each question
- Check answers at the end of the booklet
- Reflect honestly on how confident you feel on this topic
- Fill in reflection grid on Page 1

Q1

Work out the value of $\left(\frac{9}{16}\right)^{-\frac{3}{2}}$

Q2

Simplify $8^4 \div 32^{\frac{2}{5}}$

Give your answer in the form 2^m where m is an integer.

Q3

Simplify $\dfrac{\sqrt{x^3}\left(\sqrt{x^3}+x^3\right)}{\sqrt{x}}$

Give your answer in the form $x^{\frac{a}{b}}+x^c$ where a, b and c are integers.

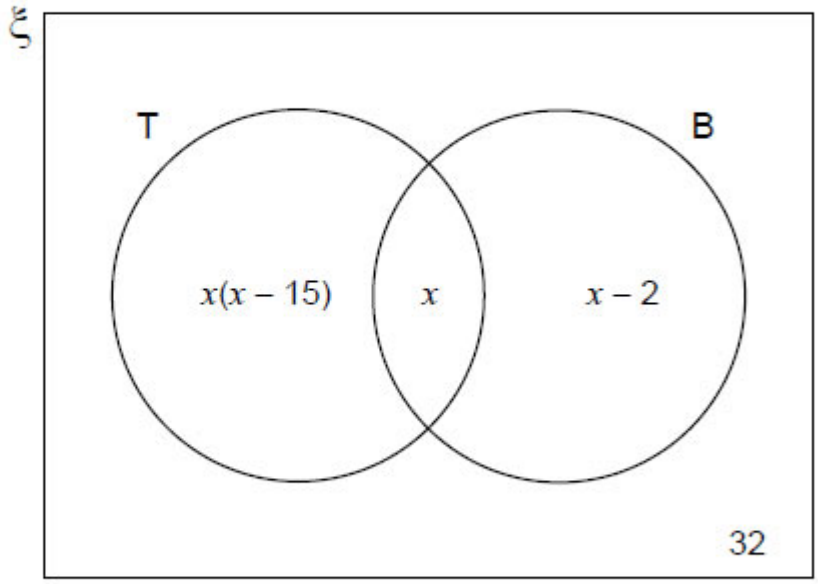
Venn Diagrams

- Attempt each question
- Check answers at the end of the booklet
- Reflect honestly on how confident you feel on this topic
- Fill in reflection grid on Page 1

Q1

The Venn diagram shows information about a coin collection.

ξ = 120 coins in the collection
T = coins from the 20th century
B = British coins



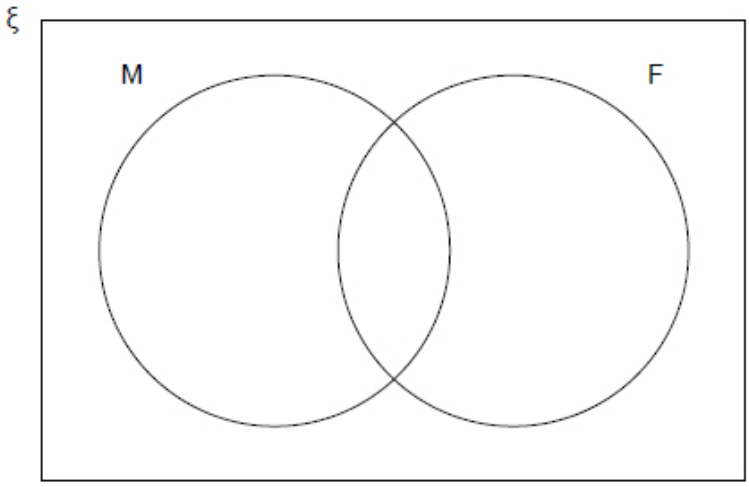
A coin is chosen at random.
It is British.

Work out the probability that it is from the 20th century.

Q2

A whole number from 1 to 15 inclusive is picked at random.

ξ = Whole numbers from 1 to 15 inclusive
M = Multiples of 3
F = Factors of 24



Using the Venn diagram, work out which of these probabilities is greater

P (the number is a multiple of 3 given it is a factor of 24)
or
P (the number is a factor of 24 given it is a multiple of 3)

You **must** show your working.

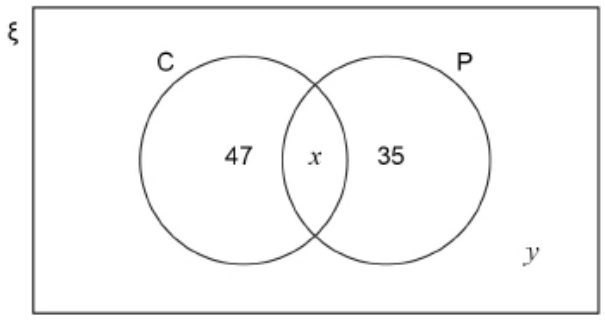
Q3

The Venn diagram shows some information about 150 students.

ξ = 150 students

C = students who study Chemistry

P = students who study Physics



The probability that a Physics student, chosen at random, also studies Chemistry is $\frac{5}{12}$

One of the 150 students is chosen at random.

Work out the probability that the student does **not** study either Chemistry or Physics.

Histograms

- Attempt each question
- Check answers at the end of the booklet
- Reflect honestly on how confident you feel on this topic
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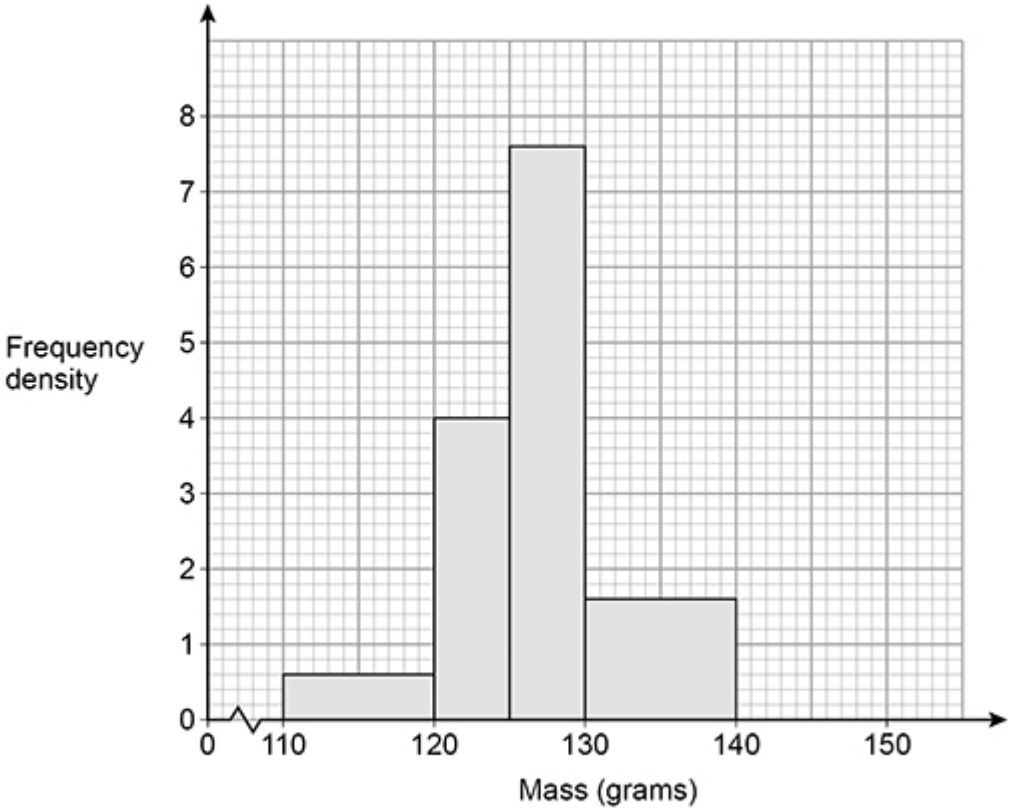
Q1

A company makes tubes of toothpaste.

The masses of 80 tubes are checked.

A histogram is drawn to represent the data.

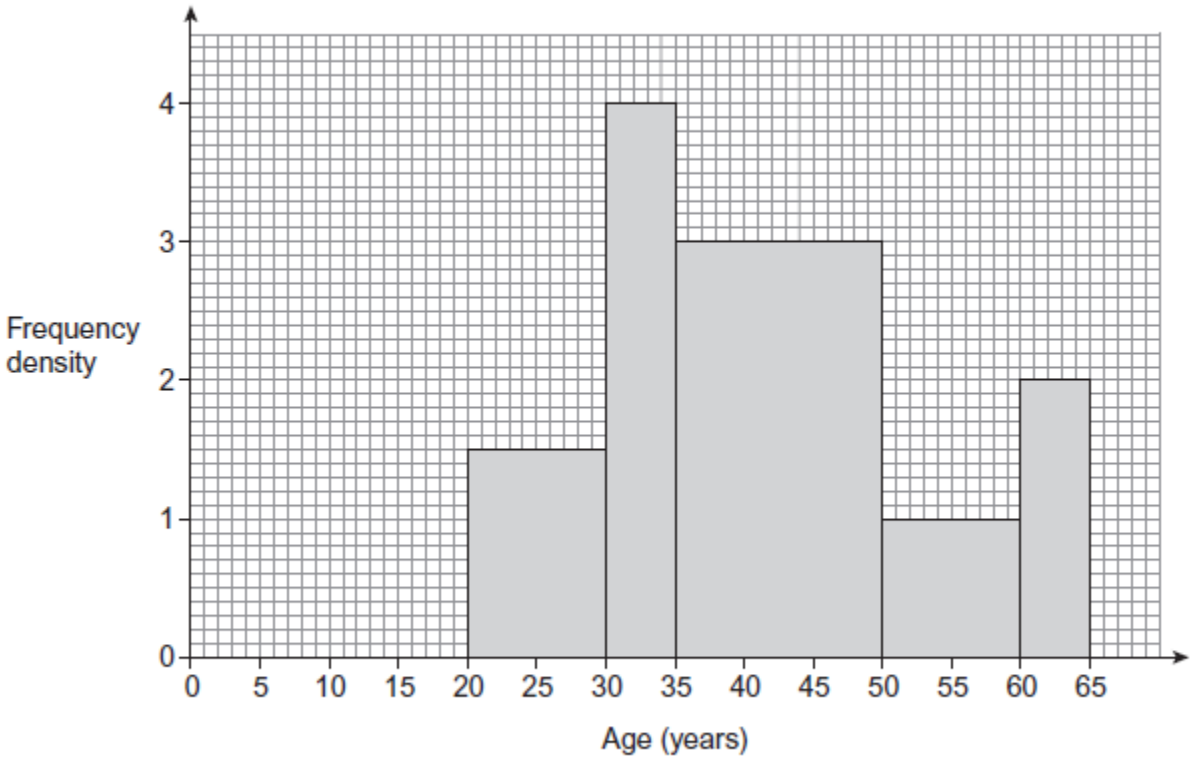


The company makes 28 000 tubes each day.

Estimate how many tubes each day have a mass **less than** 122 grams.

Q2

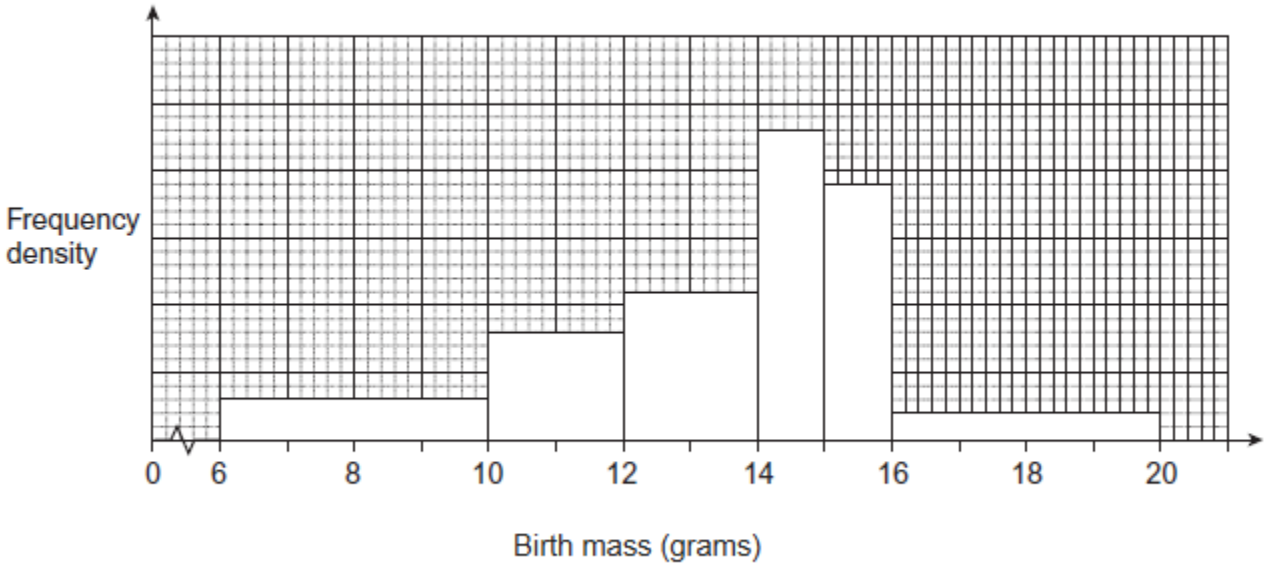
The histogram shows information about the ages of 100 employees.



Work out an estimate of the median age of the employees.

Q3

The histogram represents the birth masses of 500 mice.



Work out the number of mice with birth masses below 10 grams.

Statistical measures

- Attempt each question
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Q1

The number of goals scored by 20 players in a season is shown.

Number of goals	Frequency
0 to 4	6
5 to 9	11
10 to 14	3
	Total = 20

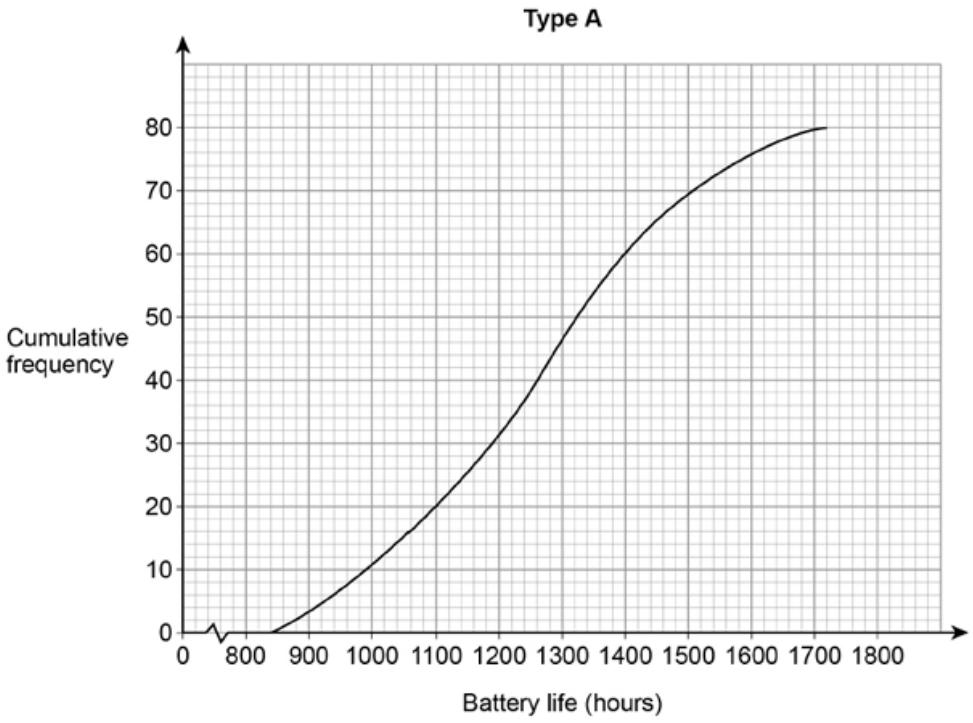
Work out an estimate of the mean number of goals per player.

Give your answer as a decimal.

Q2

Type A batteries and type B batteries were tested.

The cumulative frequency diagram shows information about the battery life of type A.

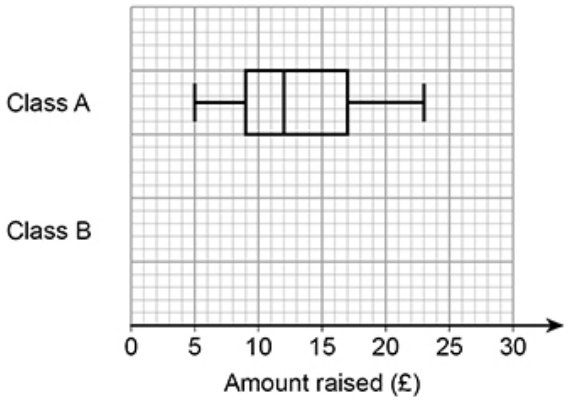


Estimate the interquartile range for type A.

Q3

Students in two classes, A and B, raised money for charity.

The box plot for class A is shown on the grid.



For class B,

- the lowest amount was £3 and the highest amount was £26
- the lower quartile was £11
- the median was £2 greater than the class A median
- the interquartile range was $1\frac{1}{2}$ times greater than the class A interquartile range.

Draw the box plot for class B on the grid.

Velocity-time graphs

- Attempt each question
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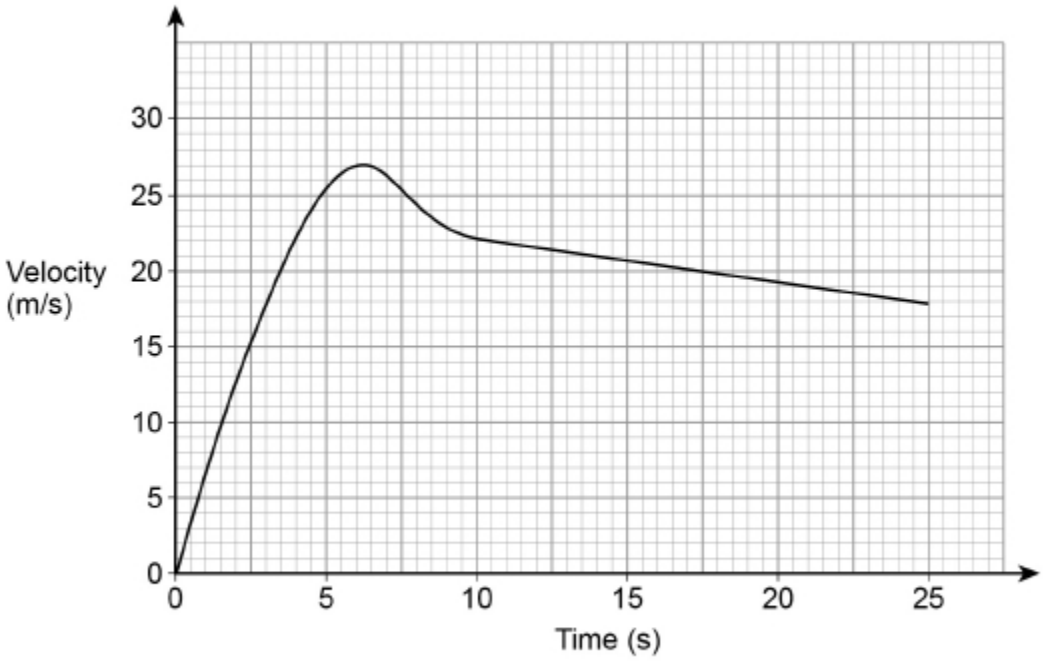
Q1

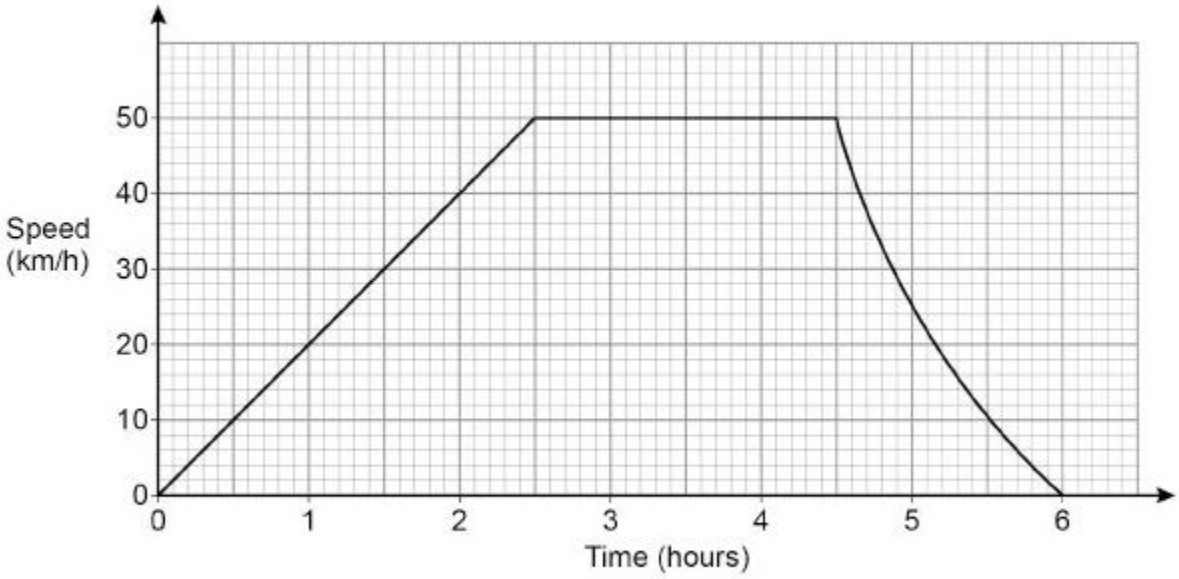
Here is a velocity-time graph of a motorbike for 25 seconds.



Work out the distance travelled in the last 15 seconds.

Q2

The speed-time graph for a train journey is shown.

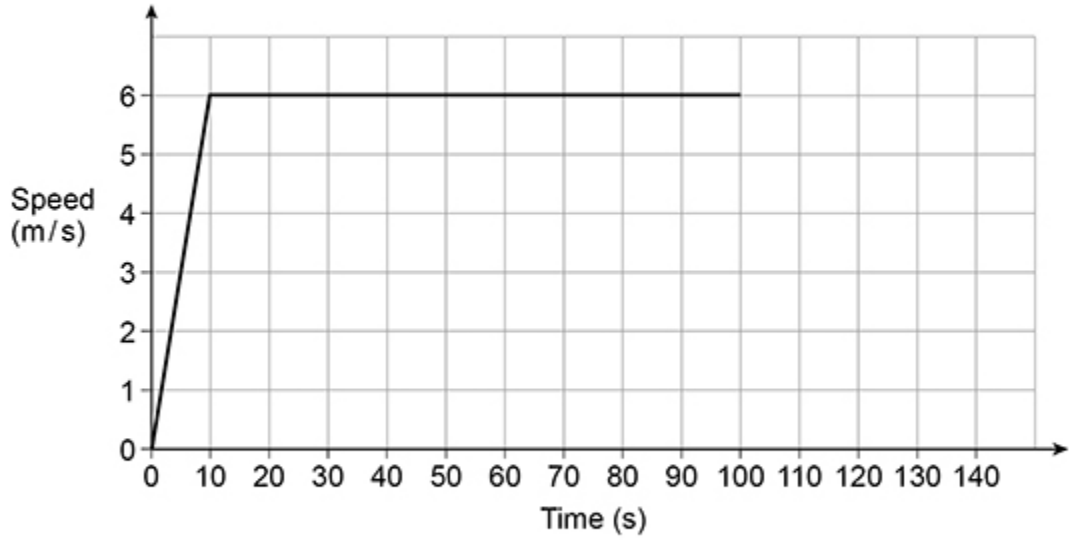


Estimate the average speed of the train for this journey.

Q3

Helena ran an 800-metre race in 140 seconds.

The speed-time graph represents the first 100 seconds of her run.



Helena ran the last 40 seconds with constant deceleration.

Work out her speed as she finished the race.

Circle Theorems

- Attempt each question
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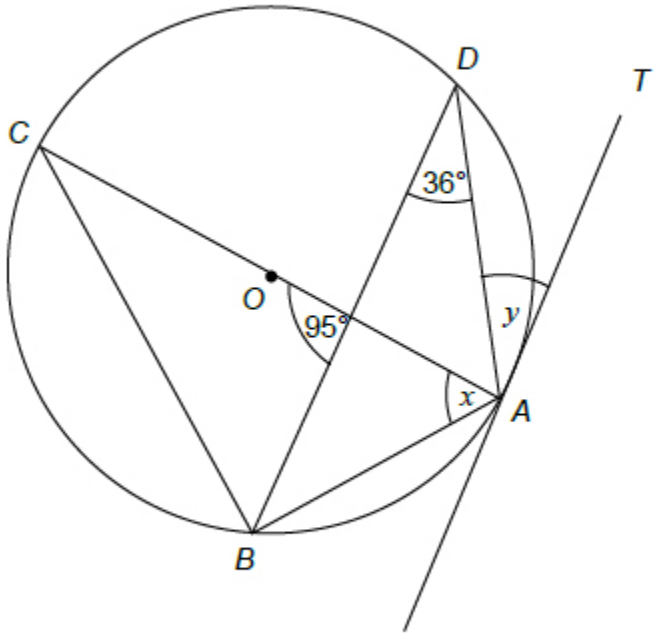
- Fill in reflection grid on Page 1

Q1

A, *B*, *C* and *D* are points on a circle, centre *O*.

AC is a diameter of the circle.



AT is a tangent to the circle.

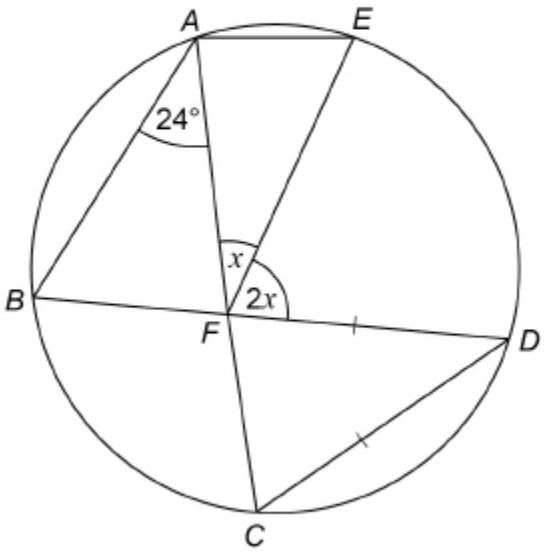
Work out the size of angle x and the size of angle y

Q2

A, *B*, *C*, *D* and *E* are points on a circle.

BFD and *AFC* are straight lines.

DC = *DF*

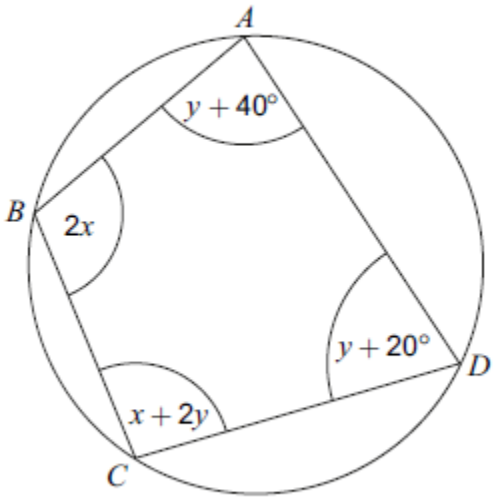


Not drawn accurately

Work out the size of angle x.

Q3

$ABCD$ is a cyclic quadrilateral.



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Work out the values of x and y.

Coordinate geometry

- Attempt each question
- Check answers at the end of the booklet
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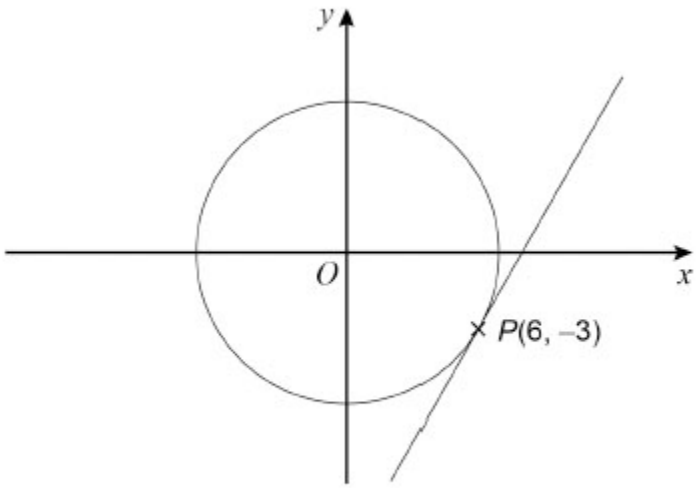
Q1

A circle with centre O and radius $\sqrt{45}$ has a tangent drawn at point $P(6, -3)$



Not drawn accurately

Work out the equation of the **tangent**.

Give your answer in the form $y = mx + c$

Q2

A straight line

is perpendicular to the straight line through (2, 8) and (6, 15)

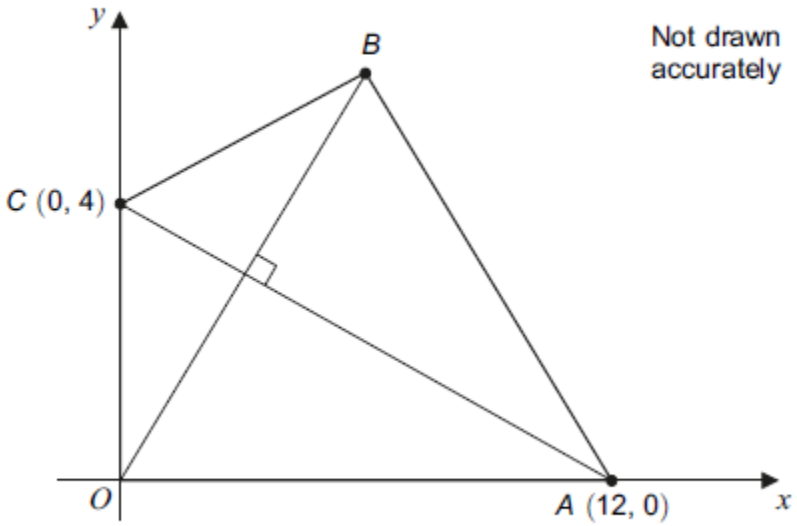
and

passes through (0, 9) and $(x, 17)$

Work out the value of x.

Q3

OABC is a kite.



Work out the coordinates of *B*.

Vector geometry

- Attempt each question
- Check answers at the end of the booklet
- Reflect honestly on how confident you feel on this topic
- Fill in reflection grid on Page 1

Q1

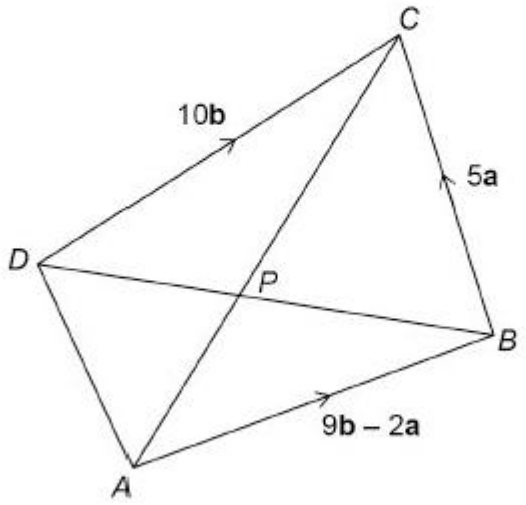
ABCD is a quadrilateral.

AC and *BD* intersect at *P*.

$\overrightarrow{AB} = 9\mathbf{b} - 2\mathbf{a}$

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

$\overrightarrow{DC} = 10\mathbf{b}$



Not drawn accurately

$BP : PD = 3 : 2$

$AP : PC = 1 : k$

Work out the value of k.

Q2

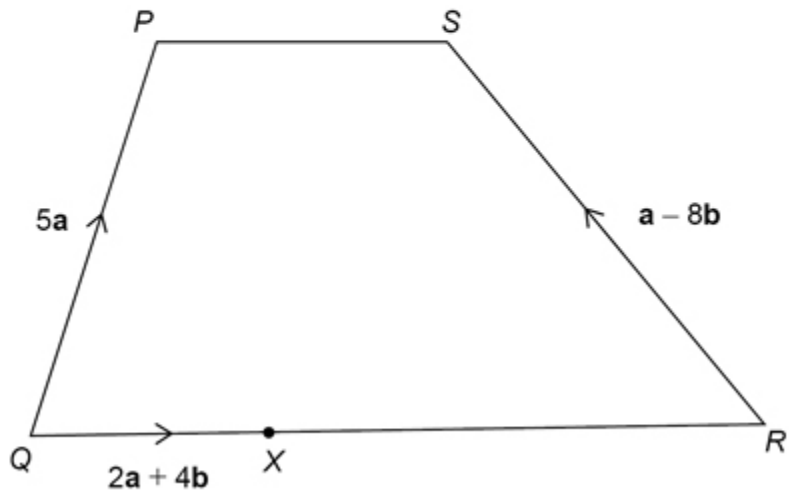
PQRS is a quadrilateral.

PQ is not parallel to *SR*.

X is a point on *QR*.

$QX : XR = 2 : 3$

$\overrightarrow{QX} = 2\mathbf{a} + 4\mathbf{b}$



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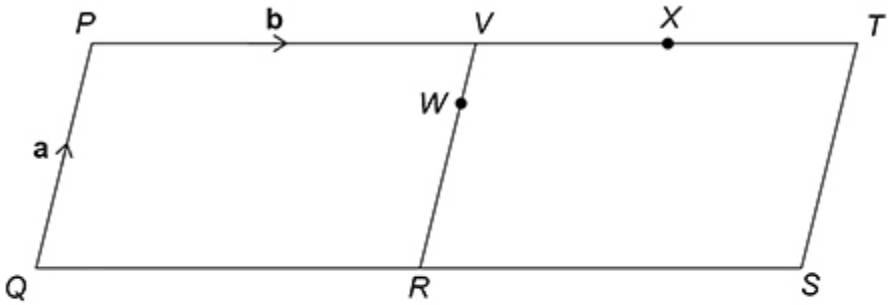
Prove that *PQRS* is a trapezium.

Q3

Two congruent parallelograms, *PQRV* and *VRST*, are joined.



Not drawn accurately

$\overrightarrow{QP} = \mathbf{a}$ $\overrightarrow{PV} = \mathbf{b}$

X is the midpoint of *VT*.

$VW : WR = 1 : 2$

Prove that *Q*, *W* and *X* lie on a straight line.

Answers

Surds

Q1

$1 : 16$

Q2

$\frac{7\sqrt{5}}{20}$

Q3

$2+\sqrt{5}$

Indices

Q1

$\frac{64}{27}$ or $2\frac{10}{27}$

Q2

2^{10}

Q3

$x^{\frac{5}{2}}+x^4$

Venn diagrams

Q1

$\frac{18}{34}$

Q2

P(Multiple 3 / Factor 24) = $\frac{3}{7}$

P(Factor 24 / Multiple 3) = $\frac{3}{5}$

Q3

$\frac{43}{150}$ or 0.286... or 0.287 or 0.29

or 28.6...% or 28.7% or 29%

Histograms

Q1

4900

Q2

40

Q3

60

Statistical measures

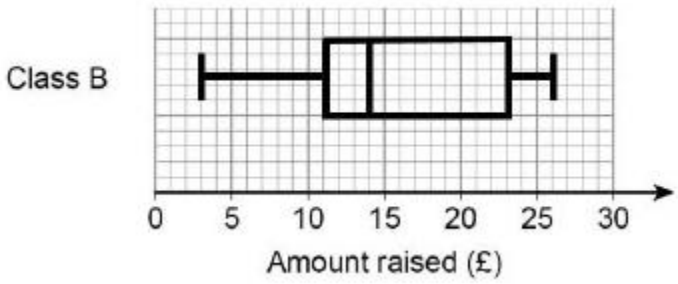
Q1

6.25

Q2

300

Q3



Velocity-time graphs

Q1

300

Q2

Any value between 31 and 35

Q3

5.5

Circle theorems

Q1

$(x =)\ 54°$ $(y =)\ 41°$

Q2

34

Q3

$x = 68$ and $y = 24$

Coordinate geometry

Q1

$y = 2x - 15$

Q2

–14

Q3

$\left(\frac{12}{5}, \frac{36}{5}\right)$ or (2.4,7.2)

Vector geometry

Q1

2

Q2

($\overrightarrow{PS}$ =) $\mathbf{a} + 2\mathbf{b}$

and

indication why *PS* is parallel to *QR*

eg $2(\mathbf{a} + 2\mathbf{b}) = 2\mathbf{a} + 4\mathbf{b}$

or $5\mathbf{a} + 10\mathbf{b} = 5(\mathbf{a} + 2\mathbf{b})$

or $\mathbf{a} + 2\mathbf{b}$ *and* $\overrightarrow{QR}$ *is a multiple of* $\overrightarrow{PS}$

Q3

Any valid pair of vectors and indication that one vector is a multiple of the other

eg $\overrightarrow{QW} = \frac{2}{3}\mathbf{a} + \mathbf{b}$

and $\overrightarrow{WX} = \frac{1}{3}\mathbf{a} + \frac{1}{2}\mathbf{b}$

and $\frac{2}{3}\mathbf{a} + \mathbf{b} = 2\left(\frac{1}{3}\mathbf{a} + \frac{1}{2}\mathbf{b}\right)$