Bentley Wood
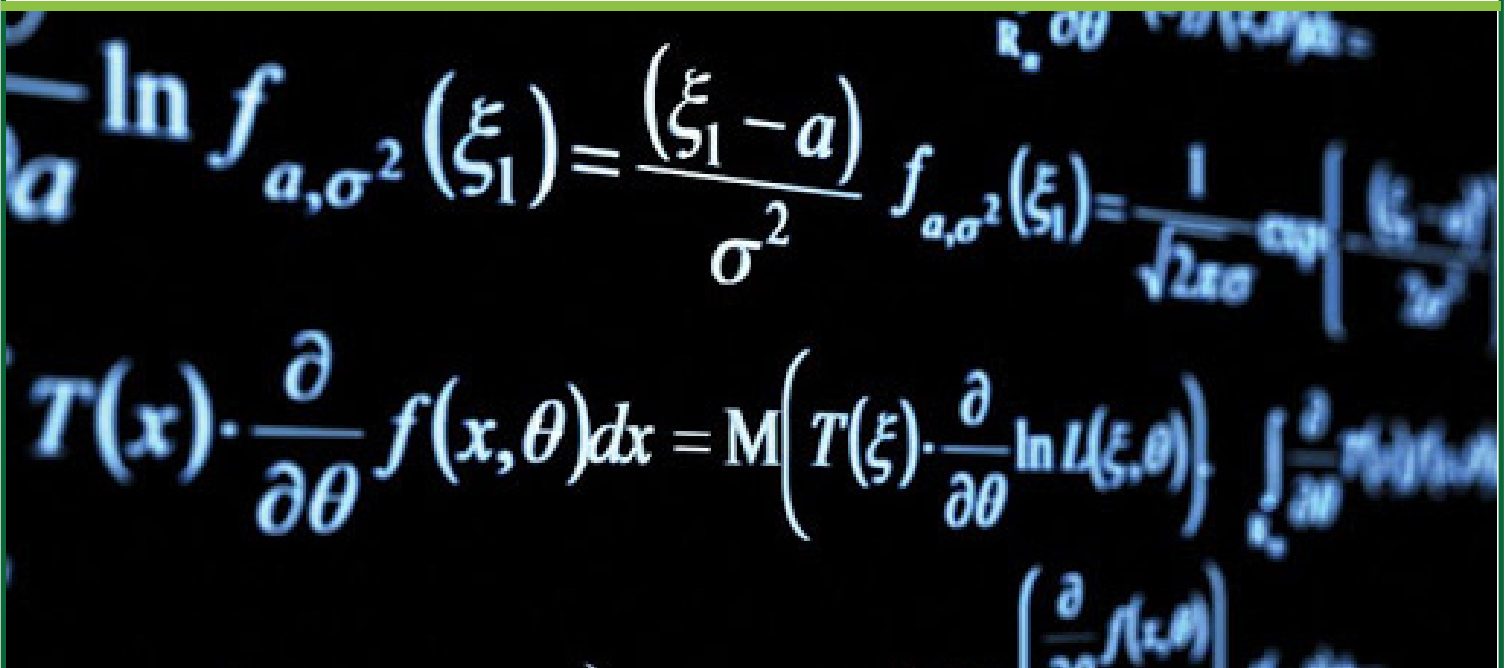
High School for Girls

Further Mathematics GCSE to A Level

Bridging Work
Year 11 into 12 for 2023/24
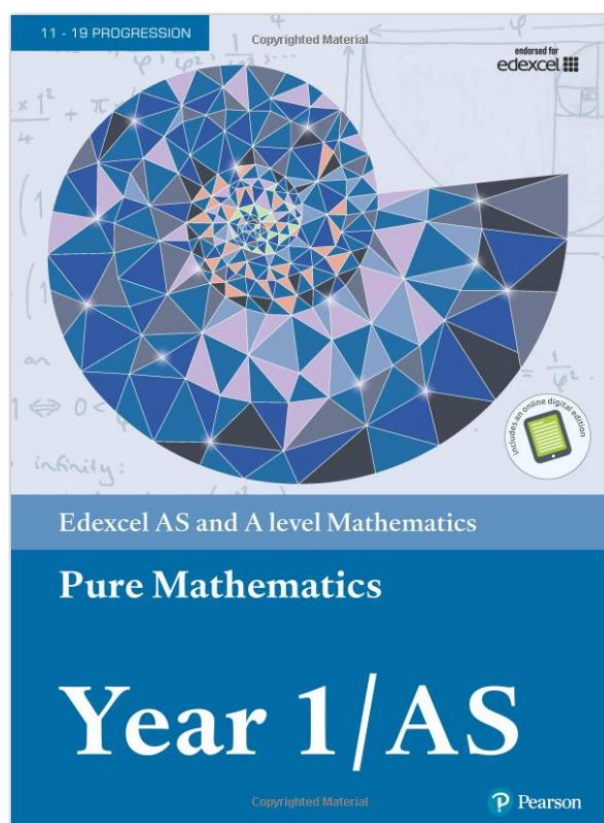
The completion of the Sparx booklet is <u>mandatory</u>. You should complete this booklet during the summer prior to starting the course as preparation for an initial assessment during the first week. Your teachers will ask to see your completed work with all your working out. You will be given the opportunity to mark your work in class as part of your first lesson.

You should take this as an opportunity which will ensure a smoother start of your A level Mathematics course. All topics are GCSE grade 7/8/9.

If you are struggling with a topic, the Sparx video/task number is listed on page 2 of your booklet.

In addition to the Sparx booklet and as a Further Maths candidate, you are also required to independently complete the first 4 chapters of the Pure 1 book and have the mixed exercise from each topic ready to show to your teachers in the first lesson back in September.

Contents

If you are having difficulty obtaining a copy of the book over the summer, email Ms Massara on amassara@bentleywood.harrow.sch.uk to discuss alternatives.

When you join us in September, prepare yourself for:

- More Maths lessons per week – 12 lessons as the Further Maths is a double A level.
- A different style of teaching.
- A lot more homework.
- Taking more responsibility for your learning, catching up & understanding.
- Organising your resources – use a ring binder with dividers.

Let's consider the implications of each of these:

More Maths lessons per week
On average, you will have 12 lessons per week (24 lessons over a two-week period). This means that topics will be covered at a faster pace than you are used to, and there will be much less time to review course content. Therefore, if you miss a lesson, the next lesson usually builds on content covered in that lesson, so it is important that you catch up as quickly as possible.

A different style of teaching
More lesson time is used for explanation by your teacher. There will be less time in lessons for you to practice new techniques, so you will have to ensure that you get adequate practice outside lessons.

A lot more homework
Your homework will be longer and more complicated. You will be expected to spend between 5 and 6 hours per week on homework, organizing your work, and reviewing material covered. The homework deadline will usually be from lesson to lesson.

Taking more responsibility for your learning
It is up to you to seek help if you do not understand something; this may have to be dealt with outside of lesson time. If you get stuck on a homework question, it is up to you to ensure there is no gap in your understanding. You can do this by checking through your notes, looking in your text book for a similar example, looking at the additional resources on Teams, asking a friend or your teacher for help. If you get back an assessment with a low grade, it is your responsibility to do corrections and follow up work to ensure your understanding of the topic is secure. Your teachers are always approachable and happy to help when you ask them.

Organising your resources
You will need a ring-binder folder with many dividers to accommodate all the different chapters of the book. Your teachers will be handing out notes, which you will need to file in the correct place in your folder. You will also be working on paper so ensure you always have enough in all your lessons.

Sparx Maths

Transition Workbook

GCSE to A-Level

In this booklet, there are a range of questions from key topics that you will have seen in GCSE and will be helpful for AS Level and A-Level.

Each topic has three sections:
- **Introduce** questions allow you to practise the key concepts.
- **Strengthen** questions build on your knowledge of the key concepts.
- **Deepen** questions will challenge your understanding.

Unless otherwise indicated, you may use a calculator.

Use the grid below to keep track of your progress in each topic. Tick the sections you have attempted. If you use Sparx Maths you can find even more questions by searching for the Sparx topic codes in Independent Learning.

	I	S	D	Sparx topic codes	Teacher comment
Surds	○	○	○	U499 U707 U281	_____
Expanding brackets	○	○	○	U768 U606	_____
Factorising quadratics	○	○	○	U178 U858	_____
Simplifying expressions	○	○	○	U662 U437	_____
Operations with algebraic fractions	○	○	○	U685 U457 U824	_____
Solving quadratic equations	○	○	○	U228 U960 U665 U150	_____
Quadratic graphs	○	○	○	U589 U769 U601	_____
Linear simultaneous equations	○	○	○	U760 U757	_____
Straight-line graphs	○	○	○	U315 U477 U848 U669 U377 U898	_____
Right-angled trigonometry	○	○	○	U283 U545 U170	_____
Further trigonometry	○	○	○	U952 U591	_____

Sparx Maths

Key facts and formulae:

The Quadratic formula:

The solution of $ax^2 + bx + c = 0$

where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Trigonometry:

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \qquad \cos A = \frac{b}{c} \qquad \tan A = \frac{a}{b}$$
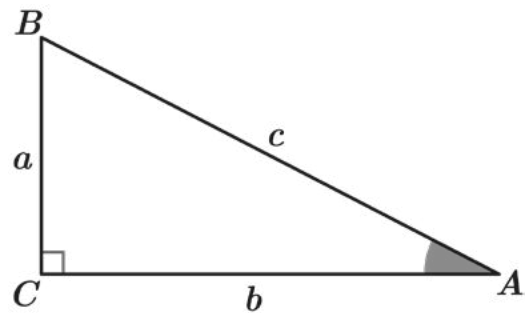
In any triangle ABC where a, b and c are the length of the sides:

sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$
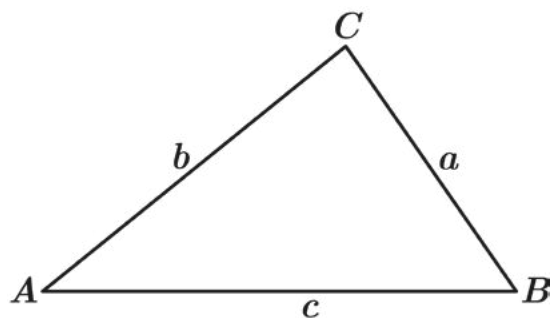
Q1 Expand and fully simplify $\sqrt{5}(\sqrt{5} + \sqrt{7})$

Answer: ....

Q2 Rationalise the denominator of $\dfrac{2\sqrt{5}}{\sqrt{6}}$

Give your answer in its simplest form.

Answer: ....

Q3 Expand and fully simplify $(6 + \sqrt{5})(1 + \sqrt{5})$

Answer: ....

Sparx Maths

Q4 Write $(5 + \sqrt{12})(11 + \sqrt{3})$ in the form $a + b\sqrt{3}$, where a and b are integers.

Answer: ....

Q5 Rationalise the denominator of $\dfrac{1 + \sqrt{2}}{\sqrt{2}}$

Give your answer as a fraction in its simplest form.

Answer: ....

Sparx Maths

Q1   Expand and fully simplify $(2\sqrt{6} - 5\sqrt{2})^2$

Answer: ....

Q2   Rationalise the denominator of $\dfrac{15 + \sqrt{3}}{10\sqrt{3}}$

Give your answer as a fraction in its simplest form.

Answer: ....

Sparx Maths   © Sparx limited

Q3   Rationalise the denominator of $\dfrac{2\sqrt{7}}{3+\sqrt{7}}$

Give your answer in its simplest form.

Answer: ....

Q4   Write $\sqrt{12} + \dfrac{33}{\sqrt{3}}$ in the form $r\sqrt{3}$, where r is an integer.

Answer: ....

Q1   Expand and fully simplify $(4 + \sqrt{7})^2 - (4 - \sqrt{7})^2$

Answer: ....

Q2   Work out the value of x in the equation below.

$x(\sqrt{11} - 2) = 21$

Give your answer in the form $a + b\sqrt{11}$, where a and b are integers.

Answer: ....

Sparx Maths

© Sparx limited

Q3

Given that h is a prime number, rationalise the denominator of $\dfrac{5h - \sqrt{h}}{\sqrt{h}}$

Give your answer in its simplest form.

Answer: ....

Q4

Calculate the unknown side length, in metres, of the rectangle below.

Give your answer in its simplest form, rationalising the denominator if necessary.

$(\sqrt{3}+1)$ m

?   area $= (7 - 2\sqrt{3})$ m²
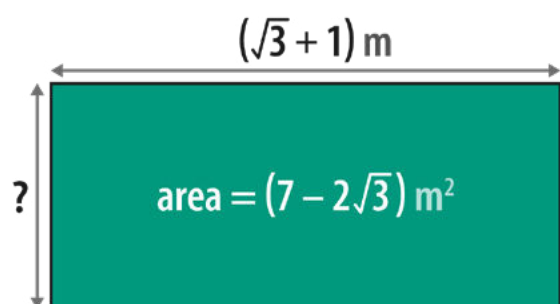
Answer: .... m

Q1

Expand and fully simplify $(m + 9)(m + 2)$

Answer: ....

Q2

Expand and fully simplify $(2a + 3)(4a + 5)$

Answer: ....

Q3 Expand and fully simplify $(x - 3)(4x + 9)$

Answer: ....

Q4 Expand and fully simplify $(6n - 5)^2$

Answer: ....

Q1   Expand and fully simplify $2(4d + 5)(3d + 1)$

Answer: ....

Q2   Expand and fully simplify $(x + 1)(x^2 + 3x + 5)$

Answer: ....

Sparx Maths

Q3   Expand and fully simplify $(3n + 4)(5n + 2) + 5(n + 7)$

Answer: ....

Q4   Expand and fully simplify $(t - 2)(t + 5)(t - 4)$

Answer: ....

Q1   Expand and fully simplify $(2x + 5)(4x - 3)(5x - 4)$

Answer: ....

Q2   Work out the values of a, b and c in the identity below.

$(3x - 1)(x + 2)(ax + b) \equiv 15x^3 + 16x^2 - 25x + c$

Answer: $a =$ .... $b =$ .... $c =$ ....

Sparx Maths

Q3 Write the following expression in the form $\dfrac{1}{ax^b} + \dfrac{1}{cy^d}$ where a, b, c, and d are integers.

$$\left(\frac{1}{5x} + \frac{1}{4y} \right)\left(\frac{1}{25x^2} - \frac{1}{20xy} + \frac{1}{16y^2} \right)$$

Answer: ....

Q4 Show that $(x^2 + 1)(y^2 + 4) \equiv (xy - 2)^2 + (2x + y)^2$

Q1 Fully factorise $y^2 + 9y + 20$

Answer: ....

Q2 Fully factorise $x^2 - x - 20$

Answer: ....

Q3 Fully factorise $w^2 - 15w + 54$

Answer: ....

Sparx Maths

Q1 Fully factorise x^2 - 16

Answer: ....

Q2 Fully factorise $2r^2 + 15r + 7$

Answer: ....

Q3 Fully factorise $5x^2 + 22x + 8$

Answer: ....

Q1   Fully factorise $49h^2 - m^2$

Answer: ....

Q2   Fully factorise $7b - b^2 - 10$

Answer: ....

Q3   Fully factorise $4k^2 - 25n^2 - (2k - 5n)^2$

Answer: ....

Sparx Maths

Q1 Fully simplify the expression $4y^5 \times 3y^2$

Answer: ....

Q2 Simplify $(h^{-5})^3$

Give your answer without any negative indices.

Answer: ....

Q3 Write $\dfrac{2t^6u}{8t^3}$ as a fraction in its simplest form.

Answer: ....

Q4

Fully simplify $\left(\dfrac{t^3}{u^5} \right)^2$

Answer: ....

Q5

Write $\dfrac{33xy + 9x}{18x}$ as a fraction in its simplest form.

Answer: ....

Q6

Fully simplify $\dfrac{6a + 42}{a^2 + 11a + 28}$

Answer: ....

Sparx Maths

Q1 Write $\dfrac{(3a)^2}{54ak}$ as a fraction in its simplest form.

Answer: ....

Q2 Fully simplify $\left(64g^8h^4\right)^{\frac{1}{2}}$

Answer: ....

Q3 Fully simplify $\dfrac{x+2}{2x^2 - 31x - 70}$

Answer: ....

Q1

Work out the values of a, b and c in the equality below.

$$\frac{2x^{20}y^4 \times 12x^4y^{26}}{(2xy^2)^3} = ax^by^c$$

Answer: $a =$ .... $b =$ .... $c =$ ....

Q2

Work out what expression should replace the ? in the equivalent fractions below.

$$\frac{?}{12r^4(t+6)} = \frac{2n}{3r}$$

Answer: ? = ...

Q3

$$\frac{ax^2 + bx + c}{dx^2 - 25} \quad \text{simplifies to give} \quad \frac{x-4}{2x-5}$$

Work out the values of a, b, c and d in the original fraction.

Answer: $a =$ .... $b =$ .... $c =$ .... $d =$ ....

Sparx Maths

Q1   Fully simplify $\dfrac{14a}{b}$ x $\dfrac{b}{2}$

Answer: ....

Q2   Fully simplify $\dfrac{6a}{v}$ ÷ $\dfrac{2a}{5}$

Give your answer as a fraction.

Answer: ....

Q3   Fully simplify the expression below to give a single fraction.

$\dfrac{n+2}{5}$ + $\dfrac{6n}{7}$

Answer: ....

Q1 Fully simplify $\dfrac{2}{5a + 4}$ x $\dfrac{45a + 36}{a}$

Give your answer as a fraction.

Answer: ....

Q2 Fully simplify $\dfrac{6x}{(5x - 7)(x + 1)}$ – $\dfrac{1}{5x - 7}$

Give your answer fully factorised.

Answer: ....

Sparx Maths

Q3 Write the following as a single fraction in its simplest form:

$$\frac{2x^2 - 11x + 12}{x + 5} \div (4x^2 - 6x)$$

Give your answer fully factorised.

Answer: ....

Q4 Fully simplify $\dfrac{4ab^2}{k}$ x $\dfrac{3ak}{12k}$ x $\dfrac{7}{5ab}$

Give your answer as a fraction.

Answer: ....

Q1 Fully simplify $\dfrac{7}{36 - x^2} - \dfrac{3}{6 + x}$

Give your answer fully factorised.

Answer: ....

Q2 Write the following as a single fraction in its simplest form:

$$6 - (x + 4) \div \dfrac{x^2 + 11x + 28}{x - 7}$$

Give your answer fully factorised.

Answer: ....

Sparx Maths

Q1

Find the two solutions to the equation

$(x - 9)(x + 5) = 0$

Answer: ....

Q2

Solve this equation by factorising:

$y^2 + 3y - 10 = 0$

Answer: ....

Q3

Solve this equation by factorising:

$12 - 8w + w^2 = 0$

Answer: ....

Q4 Using the quadratic formula, solve

$4x^2 + 16x + 15 = 0$

Answer: ....

Q5 Solve this equation by factorising:

$2m^2 - 11m + 5 = 0$

Answer: ....

Sparx Maths

Q1 Using the quadratic formula, solve $y^2 - 6y + 7 = 0$

Give your answer in the form $a \pm \sqrt{b}$

Answer: ....

Q2 Solve the equation below using factorising.

$6y^2 - 11y - 10 = 0$

Answer: ....

Q3 Using the quadratic formula, solve $6x^2 - 35 = -11x$

Answer: ....

Q4 Solve $3r(3r - 4) = 2$

Give your answers to 2 d.p.

Answer: ....

Sparx Maths

Q1   Solve $x(x + 4) - 4(5x + 9) = 0$

Answer: ....

Q2   Jessica thinks of a positive number, n, which is less than 1
         She adds this number to its reciprocal and gets 2.9

         Work out the value of n.
         Give your answer as a fraction in its simplest form.

Answer: ....

Q3

Solve $\dfrac{4}{y-1} - \dfrac{5}{y+2} = \dfrac{3}{y}$

Answer: ....

Q4

$x = \dfrac{-3 \pm \sqrt{29}}{2}$

There is only one equation of the form $x^2 + bx + c = 0$ that gives these values of x as solutions.

Work out the values of b and c.

Answer: $b =$ .... $c =$ ....

Sparx Maths

Q1

Write down the coordinates of the roots of the quadratic curve shown below.
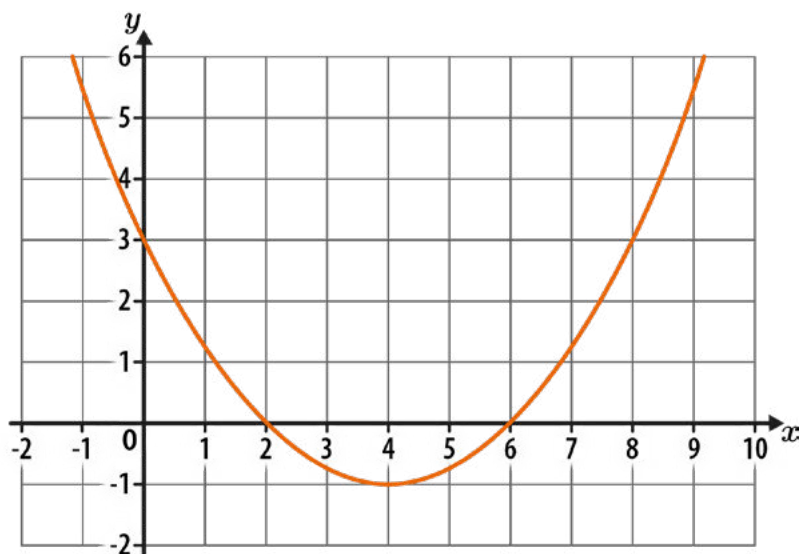
Answer: (................. , ...) and (................. , ...)

Q2

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

Estimate the solutions to $x^2 + x - 5 = 0$
Give your answers to 1 d.p.

Answer: ....

Q3
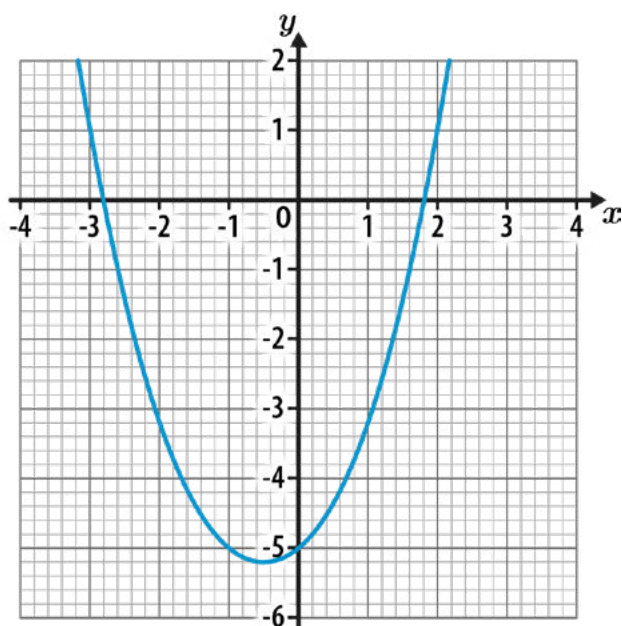
The diagram below shows the graph of the function $y = 2x^2 + 2x - 7$

Work out the solutions to $2x^2 + 2x - 7 = -3$
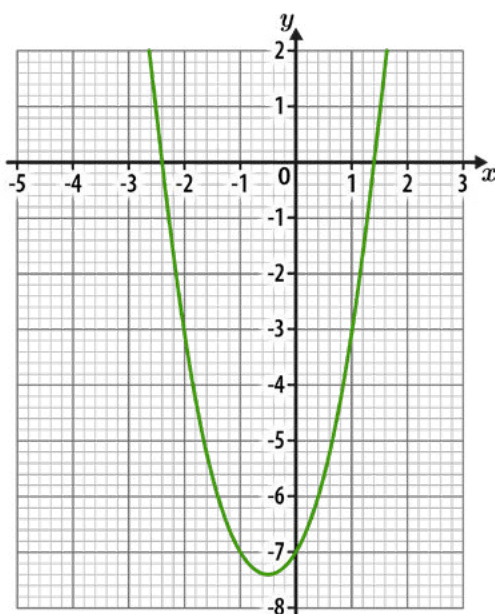
Answer: ....

Q4

a) Write $x^2 + 6x + 11$ in the form $(x + c)^2 + d$, where c and d are numbers.

Answer: a) ....

b) Hence, write down the coordinates of the turning point on the curve $y = x^2 + 6x + 11$

Answer: b) (..................... , ...)

Sparx Maths

Q1   The diagram below shows a sketch of the curve $y = x^2 + 8x - 10$

P is the turning point of the curve.

Work out the coordinates of P.
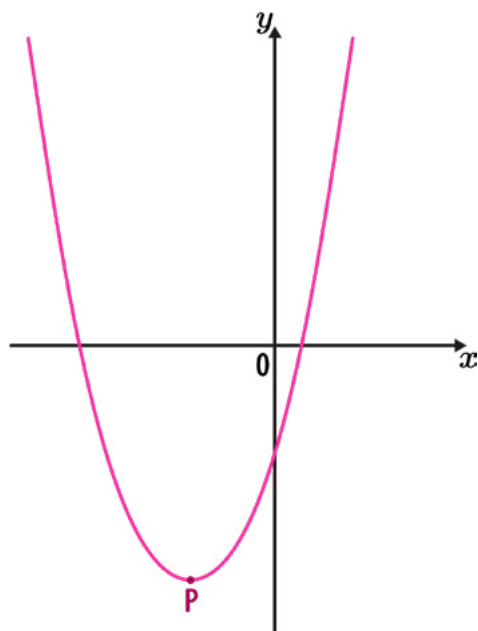
Answer: (..................... , ...)

Q2   Work out the coordinates of the turning point of the curve $y = x^2 - 5x + 1$

Answer: (..................... , ...)

Q3

The diagram below shows a sketch of the curve $y = 3x^2 - 6x - 10$

P is the turning point of the curve.

Work out the coordinates of P.
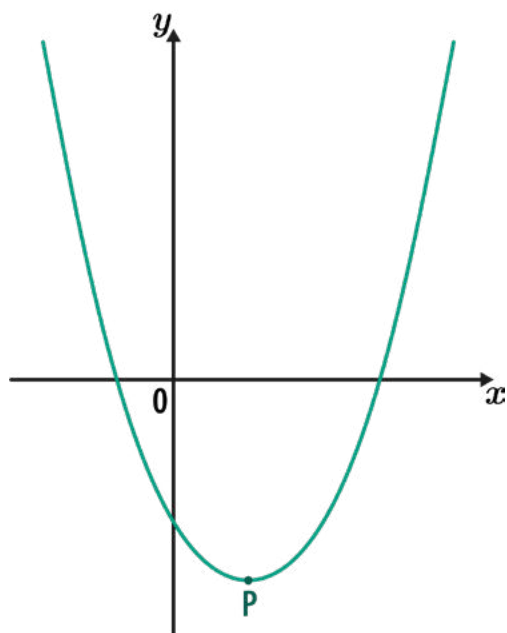
Answer: (..................... , ...)

Q4

The diagram below shows the graph of $y = 2x^2 - 5x - 3$

Use the diagram to estimate the solutions to $2x^2 - 5x - 3 = -2x + 2$
Give any decimal answers to 1 d.p.
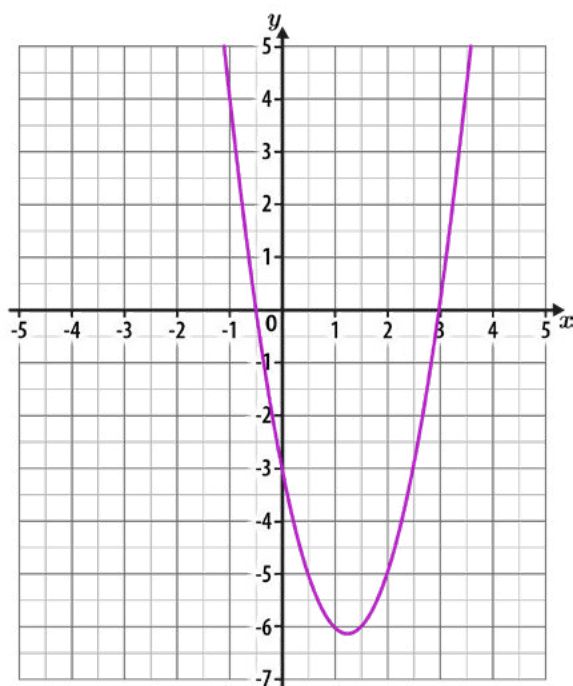
Answer: ....

Q1

The diagram below shows the graph of $y = 2x^2 + 4x - 1$
The equation $2x^2 + 4x - 1 = k$ has solutions at $x = -3$ and $x = 1$

What is the value of k?
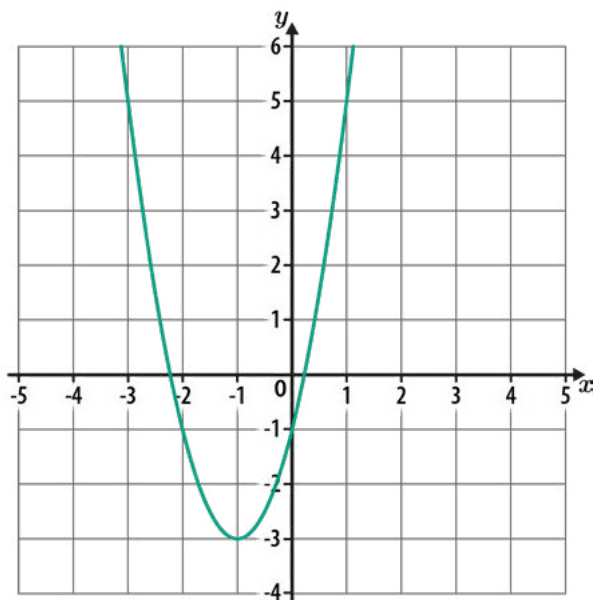
Answer: $k =$ ....

Q2

A curve has the equation $y = x^2 + ax + b$, where a and b are numbers.
The turning point of the curve is (5, 4)

Work out the values of a and b.

Answer: $a =$ .... $b =$ ....

Q3

A curve has the equation $y = -x^2 + 16x - 65$

a) Work out the turning point of the curve.

Answer: a) (.................... , ...)

b) By considering the position of the turning point and the shape of the curve, work out how many real roots $y = -x^2 + 16x - 65$ has.

Answer: b) ....

Q1   Solve the following simultaneous equations:

$6x + y = 22$

$2x + y = 10$

Answer: $x =$ .... $y =$ ....

Q2   Solve the following simultaneous equations:

$7x - 4y = 20$

$2x + 4y = 16$

Answer: $x =$ .... $y =$ ....

Q3 Solve the following simultaneous equations:

$15a - 4b = 25$

$5a + 2b = 25$

Answer: $a =$ .... $b =$ ....

Q4 Solve the following simultaneous equations:

$2x + 3y = 8$

$3x + 4y = 11$

Answer: $x =$ .... $y =$ ....

Sparx Maths

Q1   Solve the following simultaneous equations:

$7x + 5y = 8$

$3x - 2y = -9$

Answer: $x =$ .... $y =$ ....

Q2   Solve the following simultaneous equations:

$6x + 7y = 5$

$9x + 13y = -10$

Answer: $x =$ .... $y =$ ....

Q3

Solve the following simultaneous equations:

$$7y + 2x = \frac{23}{2}$$

$$5y + 3x = 9$$

Answer: $x =$ .... $y =$ ....

Q4

Solve the following simultaneous equations:

$$4.6t + 8.1u = 104$$

$$3.8t - 2.7u = -8$$

Answer: $t =$ .... $u =$ ....

Sparx Maths

Q1 Solve the following simultaneous equations:

$3x = 3 - 4y$

$12y + 11 = -5x$

Answer: $x =$ .... $y =$ ....

Q2 Find the values of x, y and a by solving the following simultaneous equations:

$6x - 7y = -10$

$12x - 5y = 16$

$2x + ay = 10$

Answer: $x =$ .... $y =$ .... $a =$ ....

Q3   Solve the following simultaneous equations:

$$\frac{4}{7x-4} = \frac{1}{6y}$$

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

Answer: $x =$ .... $y =$ ....

Q4   Solve the following simultaneous equations:

$$2^x = 4^{(7-2y)}$$

$$3^{(5x-13y)} = 81$$

Answer: $x =$ .... $y =$ ....

Sparx Maths

Q1   Work out the equation of the straight line shown below.
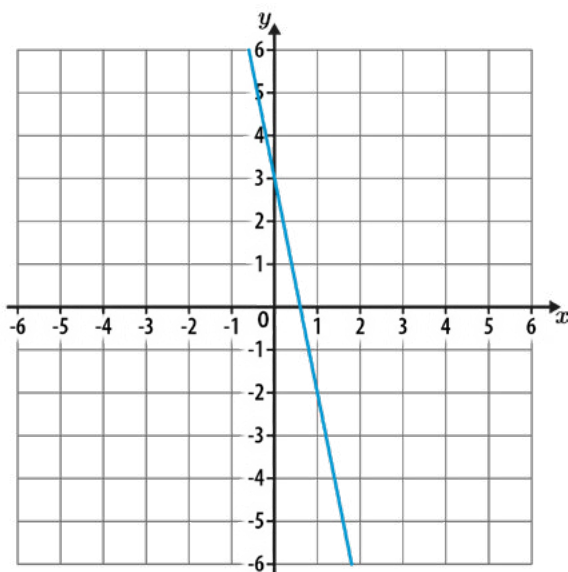
Answer: ....

Q2   Work out the equation of the straight line that is parallel to line A and passes through point P.
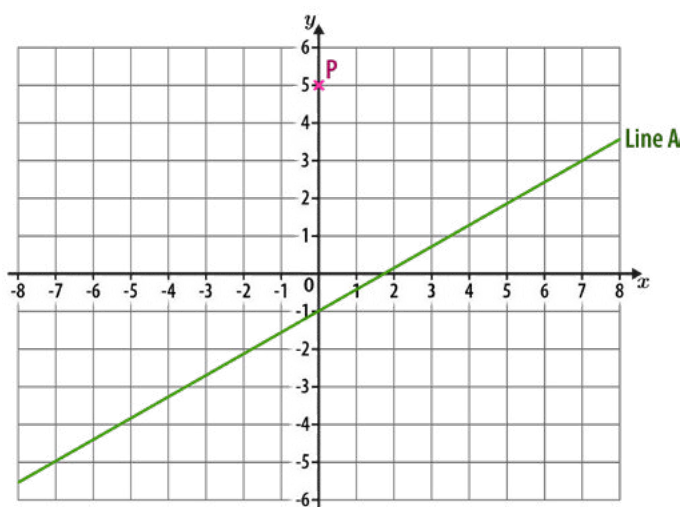
Answer: ....

Q3   Line A has the equation $2y - 10 = 16x$
Line B is perpendicular to Line A.

What is the gradient of Line B?

Answer: ....

Q4 A straight line has a gradient of 3 and passes through the point (2, 10)

Work out the equation of the line.

Answer: ....

Q5 Work out the equation of the straight line that passes through (2, 3) and (5, 18)

Answer: ....

Sparx Maths

Q1

A straight line has a gradient of $-\dfrac{3}{4}$, and passes through the point (32, 12)

Work out the equation of the line.

Answer: ....

Q2

The diagram below shows point P and Line A.
Line B is **perpendicular** to line A and passes through point P.

What is the equation of line B?

P (3, 5)

Line A
$y = -3x + 8$
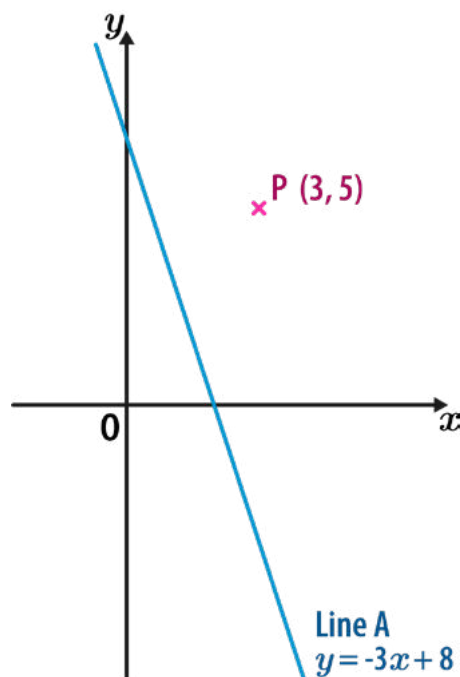
Answer: ....

Q3 Work out the equation of the straight line that passes through (1, -7) and (6, 8)

Answer: ....

Q4 The graph below shows line P and line Q.
Line Q is **parallel** to line P.

What is the equation of line Q?
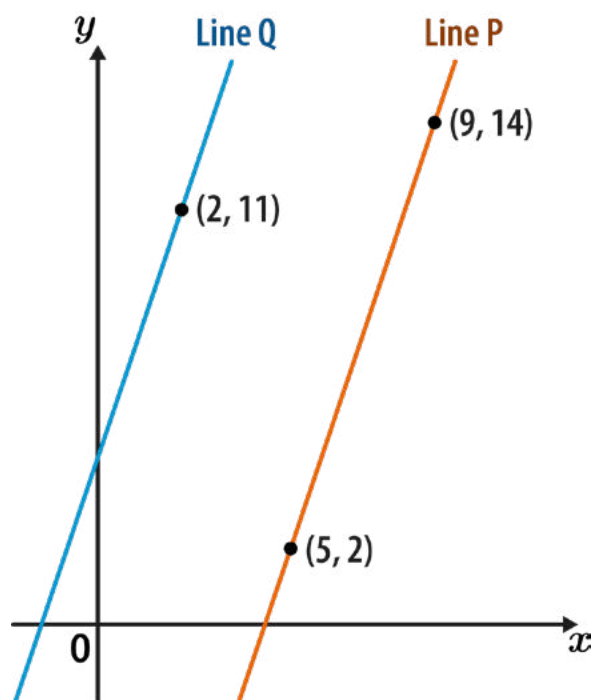
Answer: ....

Q1   Write an expression, in terms of h, for the gradient of a line **perpendicular** to the line segment joining $(3h, 20)$ to $(6h, 8)$

Give your answer as a fully simplified fraction.

Answer: ....

Q2   The triangle ABC has an area of 24 square units.

What are the coordinates of point B?

Answer: (..................... , ...)

Q3
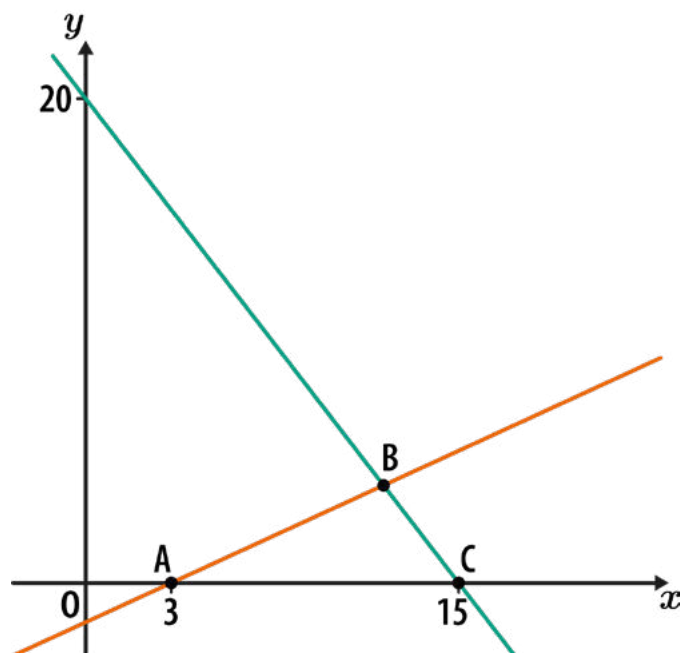
Line A has the equation $y + 2x = 14$
The gradient of line B is twice the gradient of line A.

Work out the ratio of the length of OQ to the length of OR.
Give your answer in its simplest form.
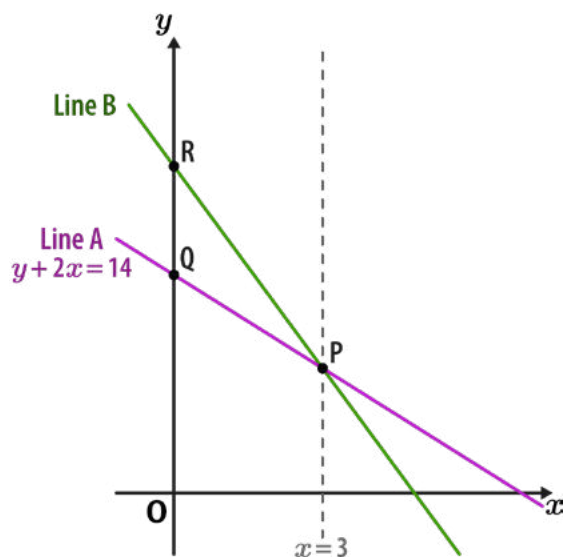
Answer: ....

Q4

A circle, centre O, passes through the point (6, -12), as shown.

Work out the equation of the tangent to the circle at this point.
Give your answer in the form $y = mx + c$, where m and c are integers or fractions in their simplest form.

Answer: ....

Sparx Maths
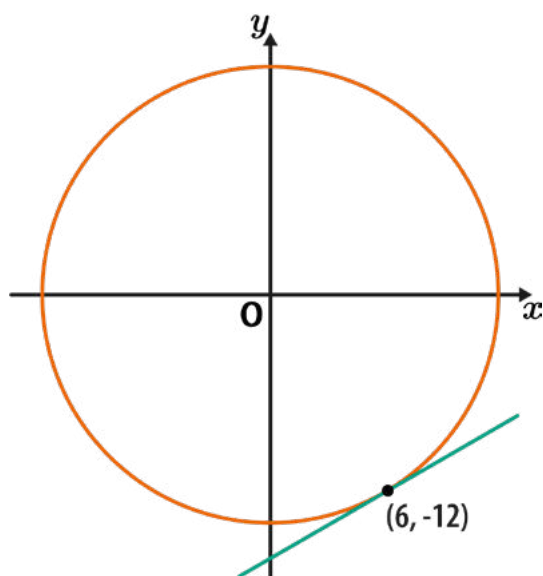
Q1 Work out the length g.
Give your answer to 1 d.p.

6.2 mm

47°

g
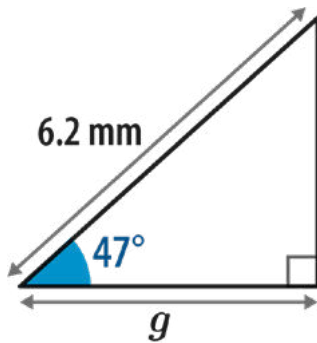
Not drawn accurately

Answer: .... mm

Q2 Work out the length k.
Give your answer to 1 d.p.

k

36°

7.7 cm
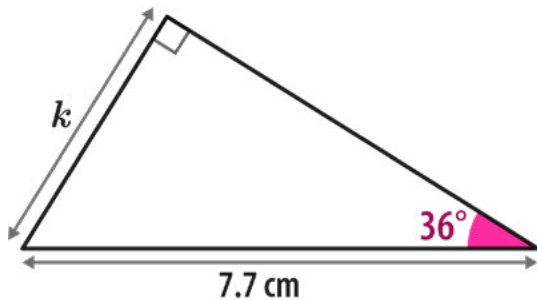
Not drawn accurately

Answer: .... cm

Q3 Calculate the size of angle y.
Give your answer to the nearest integer.

y

11.4 cm

13.2 cm
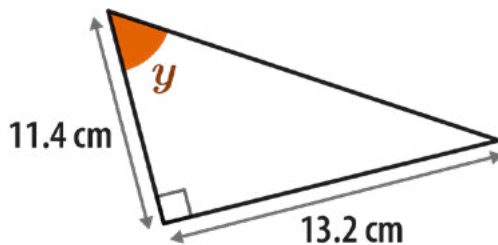
Not drawn accurately

Answer: .... °

Q1 Calculate the length y.
Give your answer to 2 d.p.

14.6 m

53°

y
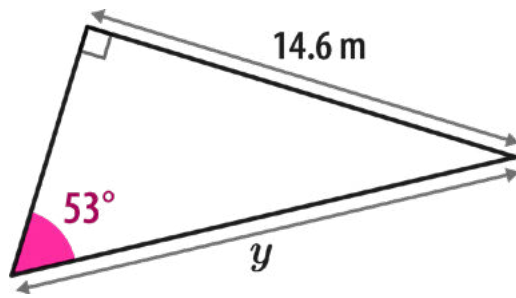
Not drawn accurately

Answer: .... m

Q2 Calculate the size of angle BAC.
Give your answer to 1 d.p.

A ← 29.1 m → B

24.6 m

C
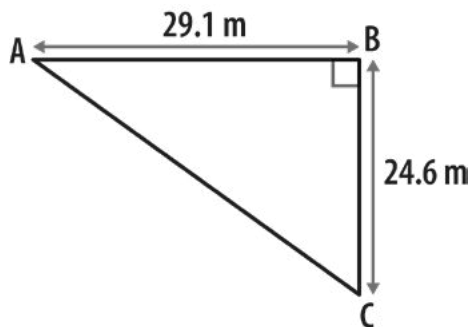
Not drawn accurately

Answer: .... °

Q3 What is the size of angle x?
Give your answer to 1 d.p.

13.94 mm

x

12.3 mm

6.56 mm

Not drawn accurately

Answer: .... °

Sparx Maths
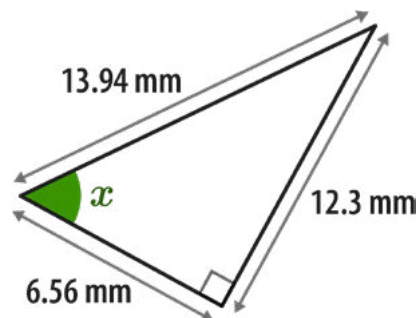
Q1

Calculate the size of angle θ.
Give your answer to 1 d.p.

5.9 cm

θ

4.6 cm
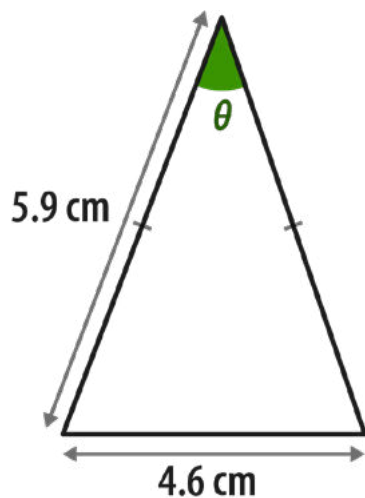
Not drawn accurately

Answer: .... °

Q2

Work out the length y.
Give your answer to 2 d.p.

13.2 cm

65°

50°

y

Not drawn accurately

Answer: .... cm

Q3

The graph below shows the line with equation $y = 5x + 2$
The axes both have the same scale.

Calculate the size of angle θ.
Give your answer in degrees to the nearest integer.
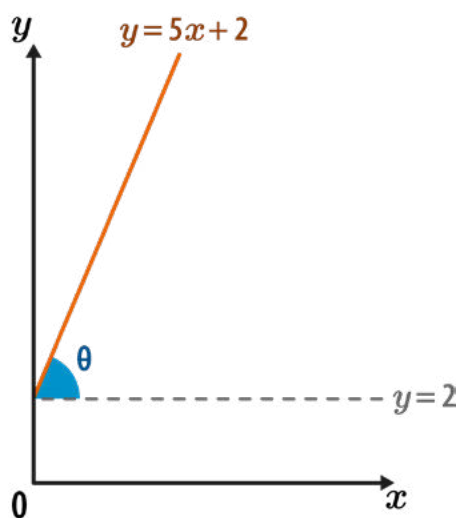
Not drawn accurately

Answer: .... °

Q4

The shape below is a regular hexagon.

Use trigonometry to calculate the distance p.
Give your answer in centimetres to 2 d.p.

Not drawn accurately

Answer: .... cm

Sparx Maths
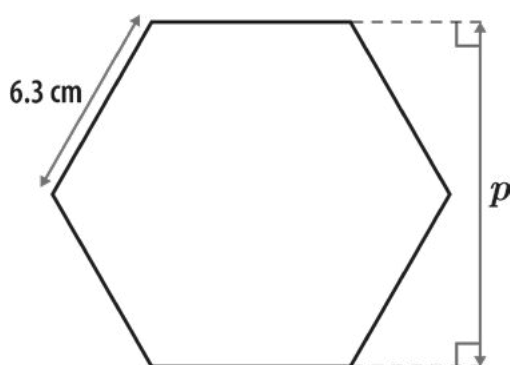
Q1 Using the sine rule, calculate the length x.
Give your answer to 1 d.p.

40°

x

57°

9 cm
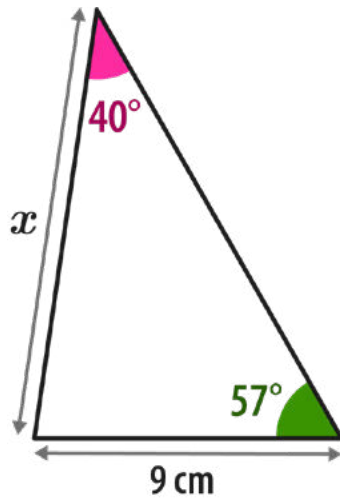
Not drawn accurately

Answer: .... cm

Q2 Using the cosine rule, work out the length y.
Give your answer to 1 d.p.

65° 6 m

11 m

y
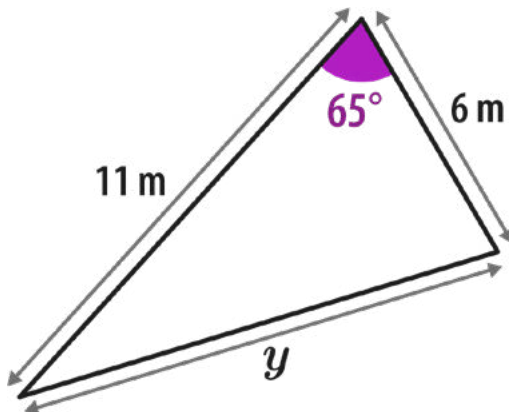
Not drawn accurately

Answer: .... m

Q3   Use the sine rule to calculate angle θ.
Give your answer to 1 d.p.

7 cm

72°

θ

10 cm
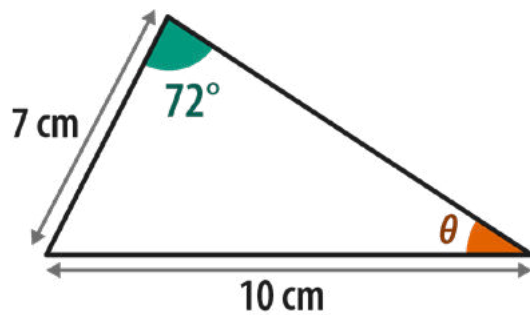
Not drawn accurately

Answer: .... °

Q4   Use the cosine rule to calculate the size of angle x.
Give your answer to the nearest degree.

17 cm

19 cm

x

13 cm
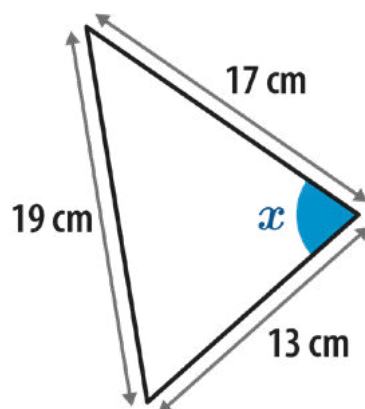
Not drawn accurately

Answer: .... °

Q1   Work out length x.
Give your answer to 1 d.p.

149°

x

1.5 cm

1.8 cm
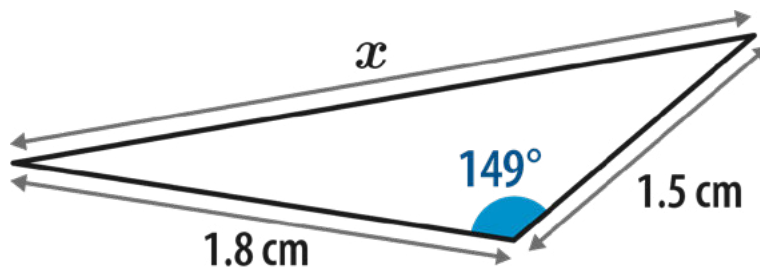
Not drawn accurately

Answer: .... cm

Q2   All the angles in the triangle below are acute.
Calculate the angle θ to 1 d.p.

θ

9 cm

6 cm

35°

Not drawn accurately

Answer: .... °

Q1
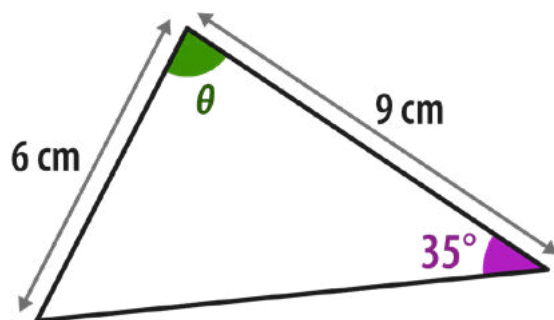
Calculate the length d.
Give your answer to 2 s.f.

32°

d

29°

2.7 cm
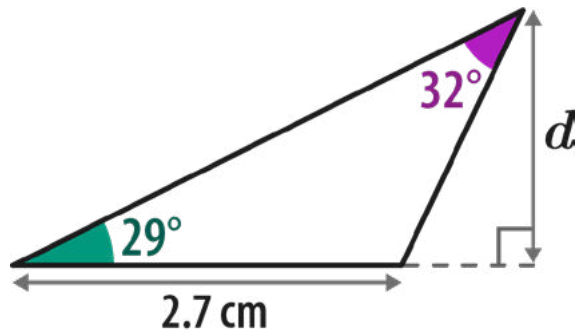
Not drawn accurately

Answer: .... cm
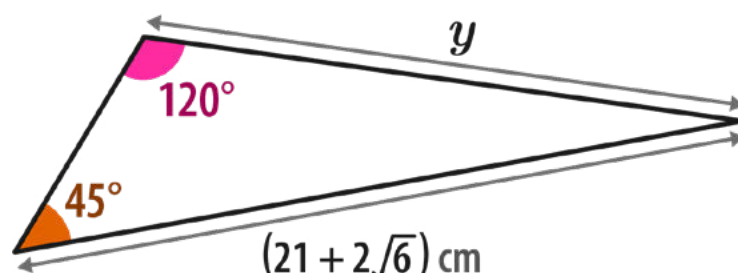

Q2

Work out the length y in the triangle below.
Give your answer in its simplest form, rationalising the denominator if necessary.
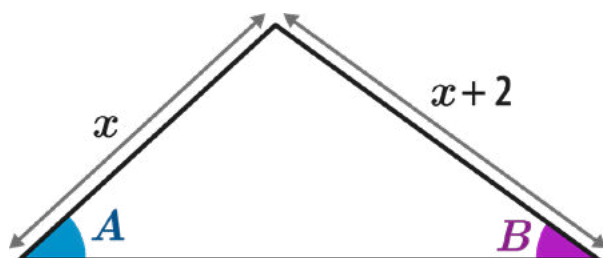

y

120°

45°

$(21 + 2\sqrt{6})$ cm

Not drawn accurately

Answer: .... cm

Sparx Maths

Q3

Using the information below, work out the value of x.

$\sin A = \dfrac{4}{5}$ $\qquad$ $\sin B = \dfrac{3}{4}$

Not drawn accurately

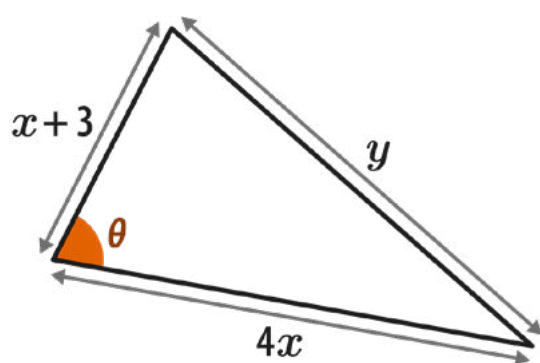Answer: ....

Q4

Given that $\cos\theta = \dfrac{1}{8}$ in the triangle below, show that $y^2 = ax^2 + bx + c$ where a, b and c are numbers.

What are the values of a, b and c?

Not drawn accurately

Answer: $a = $ .... $b = $ .... $c = $ ....

1 hour of Sparx Maths a week significantly improves student grades
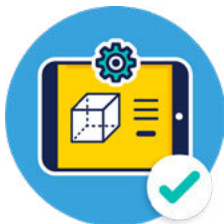
Can save up to 200 hours of teacher time per year

Covers ages 11–16 for UK and international mathematics curricula

Provides powerful, actionable insights for school leaders and teachers

The market leaders in maths

Also includes a tables module which includes a baseline assessment for your year 7s

sparxmaths.com