



A-Level Maths pre-course materials

The following maths skills are fundamental to success in A-Level mathematics.

All of these questions should be attempted on lined paper.

In your first lesson, your teacher will be expecting to see your work you have done over summer.

There are videos to watch if you get stuck.

You need to:

- On file paper, attempt every question.
- Mark your answers using the final answers at the end.
- Make **full corrections** (not just writing the correct answer).
- Bring your work to your first lesson.

Remember, to study A-Level mathematics you need a grade 6 at GCSE.



Laws of Indices

Remember that $x^a \times x^b = x^{a+b}$, $x^a \div x^b = x^{a-b}$ and $(x^a)^b = x^{ab}$.

Also recall that, for example, $4^{\frac{3}{2}} = (\sqrt{4})^3 = 8$ and $4^{-3} = \frac{1}{4^3} = \frac{1}{64}$.

1) Evaluate:

a) 14^0 **b)** $(-5)^0$

2) Evaluate:

a) $49^{\frac{1}{2}}$ **b)** $64^{\frac{1}{3}}$ **c)** $25^{\frac{3}{2}}$ **d)** $16^{\frac{3}{4}}$

3) Evaluate:

a) 5^{-2} **b)** 4^{-3} **c)** $27^{-\frac{2}{3}}$ **d)** $\left(\frac{9}{16}\right)^{-\frac{1}{2}}$

4) Evaluate:

a) $\frac{4x^2 \times x^3}{2x^2}$ **b)** $(3x^7)^2 \times x^3$ **c)** $\frac{10x^5}{2x^2 \times x^{-3}}$ **d)** $\frac{y^2}{\frac{1}{y^2} \times y}$

e) $\frac{c^{\frac{1}{2}}}{c^2 \times c^{\frac{3}{2}}}$ **f)** $\frac{y^{\frac{1}{2}} \times y^{\frac{3}{2}}}{y^{-2} \times y^3}$ **g)** $\frac{7x^3y^2}{14x^5y}$ **h)** $\frac{(2x^2)^3}{4x^0}$

Answer the questions below. The final answers are at the end of the document.

Need help with this topic? Here are some video to help you!

[Video 1](#)

[Video 2](#)



Surds

When simplifying a surd, we find the largest square number that divides the number under the square root. For example, $\sqrt{12} = \sqrt{3}\sqrt{4} = 2\sqrt{3}$.

When rationalising, we multiply by a fraction to remove the surd on the denominator.

For example, $\frac{2}{\sqrt{5}}$ would be multiplied by $\frac{\sqrt{5}}{\sqrt{5}}$, whereas $\frac{1}{2+\sqrt{3}}$ would be multiplied

1) Simplify

a) $\sqrt{45}$ **b)** $\sqrt{125}$ **c)** $\sqrt{300}$

2) Simplify

a) $\sqrt{50} + \sqrt{8}$ **b)** $\sqrt{45} - 2\sqrt{5}$

3) Expand and simplify

a) $(2 + \sqrt{3})(2 - \sqrt{3})$ **b)** $(3 + \sqrt{2})(4 + \sqrt{2})$ **c)** $(1 - \sqrt{2})(2 - 2\sqrt{2})$ **d)** $(3 - \sqrt{5})^2$

4) Rationalise:

a) $\frac{10}{\sqrt{5}}$ **b)** $\frac{2}{3 + \sqrt{2}}$ **c)** $\frac{1 + \sqrt{2}}{2 + \sqrt{2}}$ **d)** $\frac{\sqrt{3}}{2 - \sqrt{3}}$

by $\frac{2 - \sqrt{3}}{2 - \sqrt{3}}$.

Answer the questions below. The final answers are at the end of the document.

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[Simplifying Surds](#)

[Expanding Surds](#)

[Rationalising Surds 1](#)

[Rationalising Surds 2](#)



Expanding (2 and 3 brackets) and Factorising

When expanding a bracket, there are many methods – but the easiest way to not miss terms is using a grid.

When factorising, you need to ask yourself “is it one bracket or two brackets”

$x^2 + 2x$ is one bracket because both terms have a factor of x .

$x^2 - 1$ is two brackets because it is a difference of two squares.

1) Expand

a) $(x + 2)(x - 1)$ **b)** $(3x - 4)(2x - 3)$ **c)** $4x(2x^2 + 3y^3)$ **d)** $(a - 2x)^2$

2) Expand

a) $(2x + 1)(x + 2)(x - 3)$ **b)** $(3x + 2)(x - 3)^2$

3) Factorise

a) $x^2 + 3x - 18$ **b)** $8x^2 - 12x$ **c)** $x^2 - 81$ **d)** $2x^2 + x - 6$

e) $2x^2 - 8$ **b)** $2x^2 - 8x$ **c)** $4x^2 - 28x + 49$ **d)** $a^2 + 3ab + 2b$

$x^2 + 2x + 1$ is two brackets because it is 3 terms long.



Solving Quadratic Equations

When solving a quadratic, it's always important that it **must** equal 0.

Also, check if quadratics can be divided through by a factor before solving.

For example, to solve $2x^2 + 6x = 8$:

$$2x^2 + 6x - 8 = 0 \text{ (make the quadratic equal to 0).}$$

$$x^2 + 3x - 4 = 0 \text{ (divide by 2 because we could. We can't always do this!)}$$

$$(x + 4)(x - 1) = 0 \text{ (factorise. Or use the quadratic formula if you want!)}$$

$$x = 1 \text{ or } x = 4 \text{ (state both solutions).}$$

Solve the following quadratics. Give your answers as fractions where necessary.

1. $x^2 - 2x - 24 = 0$

2. $6x^2 - 19x = 36$

3. $2x^2 = 4x + 16$

4. $(x + 2)^2 = 5x + 10$

5. $(2x + 1)(x + 2) = 2$

6. $3x + \frac{2}{x} = 7$ (hint: how could you make this a quadratic?)



Linear Simultaneous Equations

When solving linear simultaneous equations, we can either:

- Make the x or y coefficients the same and then add or subtract them.
- Substitute one of the equations into the other.

It is up to you what method to use but the second method is used much more frequently at A-Level.

1 $4x + y = 8$
 $x + y = 5$

2 $3x + y = 7$
 $3x + 2y = 5$

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

4 $3x + 4y = 7$
 $x - 4y = 5$

7 $y = x - 4$
 $2x + 5y = 43$

8 $y = 2x - 3$
 $5x - 3y = 11$

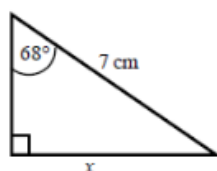
9 $2y = 4x + 5$
 $9x + 5y = 22$

10 $2x = y - 2$
 $8x - 5y = -11$

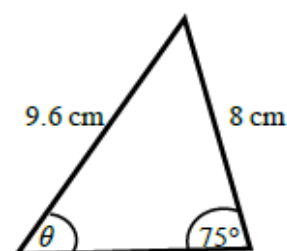
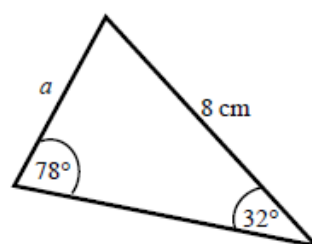
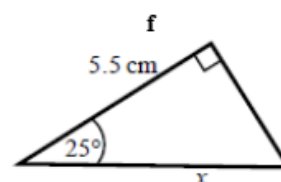
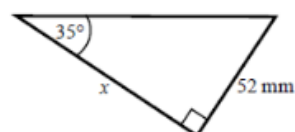
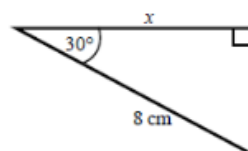
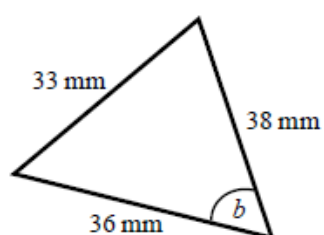
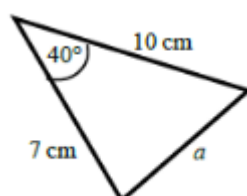
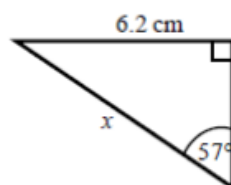
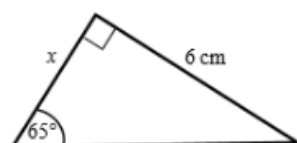


Trigonometry (SOHCAHTOA, Sine Rule and Cosine Rule)

Calculate the length of the unknown side in each triangle.
Give your answers correct to 3 significant figures.



c





Answers to each section

1), 2) and 3) are not given as they can be checked on a calculator

4)

a) $2x^3$ **b)** $9x^{17}$ **c)** $5x^6$ **d)** $\sqrt{y}$ or $y^{\frac{1}{2}}$

e) c^{-3} or $\frac{1}{c^3}$ **f)** y **g)** $\frac{1}{2}x^{-2}y$ or $\frac{y}{2x^2}$ **h)** $2x^6$

Index Laws



1) Simplify

a) $3\sqrt{5}$

b) $5\sqrt{5}$

c) $10\sqrt{3}$

2) Simplify

a) $7\sqrt{2}$

b) $\sqrt{5}$

3) Expand and simplify

a) 1

b) $14 + 7\sqrt{2}$

c) $6 - 4\sqrt{2}$

d) $14 - 6\sqrt{5}$

4) Rationalise:

a) $2\sqrt{5}$

b) $\frac{6 - 2\sqrt{2}}{7}$

c) $\frac{\sqrt{2}}{2}$

d) $2\sqrt{3} + 3$

Surds Answers



1) Expand

a) $x^2 + x - 2$ **b)** $6x^2 - 17x + 12$ **c)** $8x^3 + 12xy^2$ **d)** $a^2 - 4ax + 4x^2$

2) Expand

a) $2x^3 - x^2 - 13x - 6$ **b)** $3x^3 - 16x^2 + 15x + 18$

3) Factorise

a) $(x + 3)(x - 6)$ **b)** $4x(2x - 3)$ **c)** $(x + 9)(x - 9)$ **d)** $(2x - 3)(x + 2)$

e) $2(x - 2)(x + 2)$ **b)** $2x(x - 4)$ **c)** $(2x - 7)^2$ **d)** $(a + b)(a + 2b)$

Expanding and Factorising Answers

Quadratics Answers

1. $x = 6, x = -4$
2. $x = \frac{9}{2}, x = -\frac{4}{3}$
3. $x = 4, x = -2$
4. $x = 3, x = -2$
5. $x = 0, x = -2.5$
6. $x = 2, x = \frac{1}{3}$



Simultaneous Equations Answers

1 $x = 1, y = 4$

7 $x = 9, y = 5$

2 $x = 3, y = -2$

8 $x = -2, y = -7$

3 $x = 2, y = -5$

9 $x = \frac{1}{2}, y = 3\frac{1}{2}$

4 $x = 3, y = -\frac{1}{2}$

10 $x = \frac{1}{2}, y = 3$

Trigonometry Answers

a 6.49 cm

b 6.93 cm **c** 2.80 cm

d 74.3 mm

e 7.39 cm **f** 6.07 cm

Bottom four answers:

6.46cm, 4.33cm, 52.8 degrees, 53.6 degrees