SIR WILLIAM ROBERTSON ACADEMY

No Borders, Just Horizons...

A LEVEL MATHEMATICS SUMMER WORK

Below you will find a selection of algebra and number-based tasks aimed at preparing you for the rigours of A Level Mathematics. Complete the questions ready to hand in on your first lesson in September. It should take you a few hours to complete. There are support notes included should you need any help.

We look forward to welcoming you to our Sixth form in September!

Indices and Surds

1 Evaluate each of these without using a calculator.

a $49^{\frac{1}{2}}$ **b** $27^{\frac{1}{3}}$ **c** 5^{-1} **d** $64^{-\frac{1}{3}}$

e $9^{\frac{3}{2}}$ **f** $16^{\frac{3}{4}}$ **g** $125^{-\frac{2}{3}}$ **h** $\left(\frac{1}{2}\right)^3$

i $\left(\frac{1}{9}\right)^{-2}$ **j** $\left(\frac{4}{9}\right)^{\frac{1}{2}}$ **k** $\left(\frac{9}{16}\right)^{-0.5}$ **l** $\left(\frac{27}{8}\right)^{-\frac{2}{3}}$

2 Simplify these expressions fully without using a calculator.

a $\sqrt{8}$ **b** $\sqrt{75}$ **c** $2\sqrt{24}$ **d** $3\sqrt{48}$

e $\sqrt{20}+\sqrt{5}$ **f** $\sqrt{27}-\sqrt{12}$ **g** $5\sqrt{32}-3\sqrt{8}$ **h** $\sqrt{50}+3\sqrt{125}$

i $\sqrt{68}+3\sqrt{17}$ **j** $3\sqrt{72}-\sqrt{32}$ **k** $4\sqrt{18}-2\sqrt{3}$ **l** $6\sqrt{5}+\sqrt{50}$

3 Write each of these expressions in simplified index form.

a $x^3\times x^7$ **b** $7x^5\times 3x^6$ **c** $5x^4\times 8x^7$ **d** $x^8\div x^2$

e $8x^7\div 2x^9$ **f** $3x^8\div 12x^7$ **g** $(x^5)^7$ **h** $(x^2)^{-5}$

i $(3x^2)^4$ **j** $(6x^5)^2$ **k** $\sqrt{x^3}$ **l** $\sqrt[4]{x^5}$

m $\frac{5\sqrt{x}}{x}$ **n** $2x\sqrt{x}$ **o** $\frac{x^2}{3\sqrt{x}}$ **p** $x^3(x^5-1)$

q $x^3(\sqrt{x}+2)$ **r** $\frac{x+2}{x^3}$ **s** $\frac{\sqrt{x}+3}{x}$ **t** $\frac{(3-x^3)}{\sqrt{x}}$

u $(\sqrt{x}+3)^2$ **v** $\frac{3+\sqrt{x}}{x^2}$ **w** $\frac{1-x}{2\sqrt{x}}$ **x** $\frac{\sqrt{x}+2}{3x^3}$

Solving & Rearranging Equations/Inequalities

1 Solve each of these linear equations.

a $3(2x+9)=7$ **b** $7-3x=12$ **c** $\frac{x+4}{5}=7$ **d** $2x+7=5x-6$

e $8x-3=2(3x+1)$ **f** $\frac{2x+9}{12}=x-1$ **g** $2(3x-7)=4x$ **h** $7-2x=3(4-5x)$

2 Solve each of these linear inequalities.

a $\frac{x}{2}+7\geq 5$ **b** $3-4x<15$ **c** $5(x-1)>12+x$ **d** $\frac{x+1}{3}>2$

e $8x-1\leq 2x-5$ **f** $3(x+1)\geq\frac{x-3}{2}$ **g** $3(2x-5)<1-x$ **h** $x-(3+2x)\geq 2(x+1)$

3 Rearrange each of these formulae to make x the subject.

a $2x+5=3A-1$ **b** $x+u=vx+3$ **c** $\frac{3x-1}{k}=2x$ **d** $5(x-3m)=2nx-4$

e $(1-3x)^2=t$ **f** $\frac{1}{x}=\frac{1}{p}+\frac{1}{q}$ **g** $\frac{1}{x^2+k}-6=4$ **h** $\sqrt{x+A}=2B$

Algebraic fractions

1 Simplify these fractions.

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

2 Simplify these fractions by first factorising the numerator and the denominator.

a $\frac{x^2-2x-8}{x^2+4x+4}$ **b** $\frac{x^2-10x+21}{x^2-x-6}$ **c** $\frac{x^2-3x-10}{x^2-10x+25}$ **d** $\frac{x^2+10x+24}{2x+8}$ **e** $\frac{x^2+6x}{x^2-36}$

f $\frac{3x^2+6x}{x^2-5x-14}$ **g** $\frac{5x^3+15x^2}{x^2+6x+9}$ **h** $\frac{x^2-64}{3x^2-24x}$ **i** $\frac{25-x^2}{45-4x-x^2}$ **j** $\frac{2x^2-x-28}{2x^3+7x^2}$

Lines

1 Find the gradient of the line through each pair of points.

a (3, 7) and (2, 8) **b** (5, 2) and (−4, −6) **c** (1.3, 4.7) and (2.6, −3.1)

d $\left(\frac{1}{2},\frac{1}{3}\right)$ and $\left(\frac{3}{4},\frac{2}{3}\right)$ **e** $(\sqrt{3}, 2)$ and $(2\sqrt{3}, 5)$ **f** $(3a, a)$ and $(a, 5a)$

2 Calculate the exact distance between each pair of points.

a (8, 4) and (1, 3) **b** (− 3, 9) and (12, −7) **c** (5.9 ,6.2) and (−8.1, 3.8)

d $\left(\frac{1}{5},-\frac{1}{5}\right)$ and $\left(\frac{3}{5},-\frac{4}{5}\right)$ **e** $(5, -3\sqrt{2})$ and $(2, \sqrt{2})$ **f** $(k, -3k)$ and $(2k, -6k)$

3 Find the coordinates of the midpoint of each pair of points.

a (3, 9) and (1, 7) **b** (2, −4) and (−3, −9) **c** (2.1, 3.5) and (6.3, −3.7)

d $\left(\frac{2}{3},-\frac{1}{2}\right)$ and $\left(-\frac{5}{3},-\frac{3}{2}\right)$ **e** $(6\sqrt{5}, 2\sqrt{5})$ and $(-\sqrt{5}, \sqrt{5})$ **f** $(m, 2n)$ and $(3m, -2n)$

4 Find the equation of the line through each pair of points.

a (2, 5) and (0, 6) **b** (1, −3) and (2, −5) **c** (4, 4) and (7, −7)

d (8, −2) and (4, −3) **e** (−3, −7) and (5, 9) **f** $(\sqrt{2}, -\sqrt{2})$ and $(3\sqrt{2}, 4\sqrt{2})$

5 Use algebra to find the point of intersection between each pair of lines.

a $y=8-3x$, $y=2-5x$ **b** $y=7x-4$, $y=3x-2$ **c** $y=2x+3$, $y=5-x$

d $y+5=3x$, $y=-5x+7$ **e** $y=\frac{1}{2}x+3$, $y=5-2x$ **f** $y=3(x+2)$, $y=7-2x$

6 The line l_1 has equation $2x+6y=5$. The line l_2 is parallel to l_1 and passes through the point (1, −5). Find the equation of l_2 in the form $ax+by+c=0$ where a, b and c are integers.

7 Decide whether or not each line is parallel or perpendicular to the line $y=4x-1$

a $2x+8y=5$ **b** $20x+5y=2$ **c** $16x-4y=5$

Decide whether or not each line is parallel or perpendicular to the line $y=4-3x$

a $3x+6y=2$ **b** $5x-15y=7$ **c** $18x+6y+5=0$

8 The line l_1 has equation $4x+6y=3$. A second line, l_2 is perpendicular to l_1 and passes through the point (−1, 5). Find the equation of l_2 in the form $ax+by+c=0$ where a, b and c are integers.

Quadratics

1 Fully factorise each of these quadratics.

a $3x^2+5x$ **b** $8x^2-4x$ **c** $17x^2+34x$ **d** $18x^2-24x$

6 Use factorisation to find the roots of these quadratic equations.

a $21x^2-7x=0$ **b** $x^2-36=0$ **c** $17x^2+34x=0$ **d** $6x^2+13x+5=0$

e $4x^2-49=0$ **f** $x^2=7x+18$ **g** $x^2-7x+6=0$ **h** $21x^2=2-x$

7 Sketch each of these quadratic functions, labelling where they cross the x and y axes.

a $y=x(x-3)$ **b** $y=-x(3x+2)$ **c** $y=x(3-x)$ **d** $y=(x+2)(x-2)$

e $y=(x+4)^2$ **f** $y=15x-10x^2$ **g** $y=49-x^2$ **h** $y=-x^2+2x+3$

i $y=x^2-4x+4$ **j** $y=-x^2+14x-49$ **k** $y=3x^2+4x+1$ **l** $y=-2x^2+11x-12$

Completing the Square

1 Write each of these quadratic expressions in the form $p(x+q)^2+r$

a x^2+8x **b** x^2-18x **c** x^2+6x+3 **d** $x^2+12x-5$

e $x^2-7x+10$ **f** x^2+5x+9 **g** $2x^2+8x+4$ **h** $3x^2+18x-6$

i $2x^2-10x+3$ **j** $-x^2+12x-1$ **k** $-x^2+9x-3$ **l** $-2x^2+5x-1$

2 Use completing the square to find the turning point of each of these curves and state whether it is a maximum or a minimum.

a $y=x^2+14x$ **b** $y=x^2-18x+3$ **c** $y=x^2-9x$ **d** $y=-x^2+4x$

e $y=x^2+11x+30$ **f** $y=-x^2+6x-7$ **g** $y=2x^2+16x-5$ **h** $y=-3x^2+15x-2$

Key Points & Examples to jog your memory if needed...

Indices & Surds

Key point

$x^a \times x^b = x^{a+b}$ $\quad x^a \div x^b = x^{a-b}$ $\quad (x^a)^b = x^{ab}$

Key point

The nth root of x is written $\sqrt[n]{x} = x^{\frac{1}{n}}$, and this can be raised to a power to give $\sqrt[n]{x^m} = x^{\frac{m}{n}}$

Key point

A power of -1 indicates a reciprocal, so $x^{-1} = \frac{1}{x}$ and, in general, $x^{-n} = \frac{1}{x^n}$

Example 1

Simplify these expressions. **a** $2x^3 \times 3x^5$ **b** $12x^7 \div 4x^3$ **c** $(3x^5)^3$

a $2x^3 \times 3x^5 = 6x^{3+5}$

$= 6x^8$

Multiply the coefficients together and use $x^a \times x^b = x^{a+b}$

b $12x^7 \div 4x^6 = \frac{12x^7}{4x^6}$

$= 3x$

Since $\frac{12}{4} = 3$ and $x^a \div x^b = x^{a-b}$ so $\frac{x^7}{x^6} = x^1$ which we just write as x

c $(3x^5)^3 = 3^3(x^5)^3$

Both the 3 and the x^5 must be raised to the power 3

$= 27x^{15}$

Since $(x^a)^b = x^{ab}$

Example 2

Write these expressions in simplified index form.

a $\sqrt[3]{x}$ **b** $\frac{2}{x^3}$ **c** $\frac{2x}{\sqrt{x}}$

a $\sqrt[3]{x} = x^{\frac{1}{3}}$

b $\frac{2}{x^3} = 2x^{-3}$

c $\frac{2x}{\sqrt{x}} = \frac{2x}{x^{\frac{1}{2}}}$

Since $\sqrt{x} = x^{\frac{1}{2}}$

$= 2x^{1-\frac{1}{2}}$

Subtract the powers, remembering that $x = x^1$

$= 2x^{\frac{1}{2}}$

Example 3

Simplify these expressions without using a calculator.

a $\sqrt{18}+5\sqrt{2}$ **b** $\frac{6}{\sqrt{3}}$ **c** $\frac{2}{1-\sqrt{5}}$

a $\sqrt{18}=\sqrt{9}\sqrt{2}$

$=3\sqrt{2}$

Therefore $\sqrt{18}+5\sqrt{2}=3\sqrt{2}+5\sqrt{2}$

$=8\sqrt{2}$

b $\frac{6}{\sqrt{3}}=\frac{6\sqrt{3}}{\sqrt{3}\sqrt{3}}$

$=\frac{6\sqrt{3}}{3}$

$=2\sqrt{3}$

c $\frac{2}{1-\sqrt{5}}=\frac{2(1+\sqrt{5})}{(1-\sqrt{5})(1+\sqrt{5})}$

$=\frac{2(1+\sqrt{5})}{-4}$

$=-\frac{1}{2}(1+\sqrt{5})$

9 is a square-number factor of 18 so you can simplify $\sqrt{18}$

Collect like terms.

Rationalise the denominator by multiplying numerator and denominator by $\sqrt{3}$

Since $6 \div 3 = 2$

Rationalise the denominator by multiplying numerator and denominator by $1+\sqrt{5}$

$(1-\sqrt{5})(1+\sqrt{5})=1-\sqrt{5}+\sqrt{5}-5$
$=1-5=-4$

Solving & Rearranging Equations/Inequalities

Example 1

Solve the inequality $5(x-2)\leq 2x+1$

$5x-10\leq 2x+1$ — First expand the brackets.

$3x-10\leq 1$ — Subtract $2x$ from both sides.

$3x\leq 11$ — Add 10 to both sides.

$x\leq\frac{11}{3}$ — Divide both sides by 3

Example 2

Rearrange $Ax-3=\frac{x+B}{2}$ to make x the subject.

$2Ax-6=x+B$ — Multiply both sides by 2

$2Ax-6-x=B$ — Subtract x from both sides.

$2Ax-x=B+6$ — Add 6 to both sides.

$x(2A-1)=B+6$ — Factorise the side involving x

$x=\frac{B+6}{2A-1}$ — Divide both sides by $(2A-1)$ to make x the subject.

Algebraic Fractions

Example

Simplify the fractions **a** $\dfrac{x^2+5x+6}{2x^2+6x}$ **b** $\dfrac{2x^2-3x-9}{4x^2-9}$

a $x^2+5x+6=(x+2)(x+3)$ — Factorise numerator and denominator.

$2x^2+6x=2x(x+3)$

So $\dfrac{x^2+5x+6}{2x^2+6x}=\dfrac{(x+2)(x+3)}{2x(x+3)}=\dfrac{x+2}{2x}$ — Cancel the common factor of $x+3$ from numerator and denominator.

b $2x^2-3x-9=2x^2-6x+3x-9$ — Write $-3x$ as $-6x+3x$ since $3\times(-6)=-18$ and $2\times(-9)=-18$

$=2x(x-3)+3(x-3)$ — Factorise in pairs.

$=(2x+3)(x-3)$

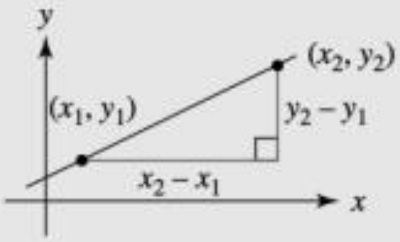
$4x^2-9=(2x+3)(2x-3)$ — Recognise the denominator as a difference of two squares.

So $\dfrac{2x^2-3x-9}{4x^2-9}=\dfrac{(2x+3)(x-3)}{(2x+3)(2x-3)}=\dfrac{x-3}{2x-3}$ — Cancel common factor $2x+3$ from numerator and denominator.

Lines

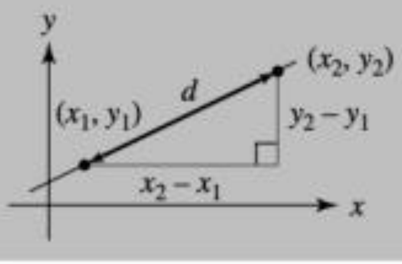
Key point

The gradient, m, of a line between two points (x_1,y_1) and (x_2,y_2) is given by $m=\dfrac{y_2-y_1}{x_2-x_1}$



Key point

The length of the line segment, d, between two points (x_1,y_1) and (x_2,y_2) is $d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$



Key point

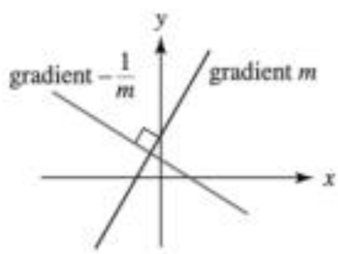
The midpoint of the line segment from (x_1,y_1) to (x_2,y_2) is $\left(\dfrac{x_1+x_2}{2},\dfrac{y_1+y_2}{2}\right)$

Key point

The equation of a straight line is $y=mx+c$ where m is the gradient and c is the y-intercept.

Key point

If the gradient of a line is m then the gradient of a perpendicular line is $-\dfrac{1}{m}$ since $m\times\left(-\dfrac{1}{m}\right)=-1$



Example 1

Work out the gradient and the y-intercept of each of these lines.

a $y=\frac{1}{2}x+4$ **b** $y+x=5$ **c** $-2x+3y+7=0$

a Gradient $=\frac{1}{2}$ and y-intercept $=4$

Since $y=mx+c$ where m is the gradient and c is the y-intercept.

b $y=5-x$

Rearrange to make y the subject.

So gradient $=-1$ and y-intercept $=5$

c $3y=-7+2x$

Rearrange to make y the subject.

$y=-\frac{7}{3}+\frac{2}{3}x$

So gradient $=\frac{2}{3}$ and y-intercept $=-\frac{7}{3}$

Example 2

Solve the simultaneous equations $5x-4y=17$, $3x+8y=5$

$15x+40y=25$ (1)

Multiply the second equation by 5

$15x-12y=51$ (2)

Multiply the first equation by 3

(1)−(2): $52y=-26$

Subtract equation (2) from equation (1) to eliminate x

$y=-\frac{1}{2}$

$5x-4\left(-\frac{1}{2}\right)=17$

Substitute $y=-\frac{1}{2}$ into one of the original equations.

$5x+2=17$

Solve this equation to find the value of x

$5x=15$

$x=3$

Example 3

Decide whether or not each line is parallel or perpendicular to the line $y=4x-1$

a $2x+8y=5$ **b** $20x+5y=2$ **c** $16x-4y=5$

First note that the gradient of $y=4x-1$ is 4

a $2x+8y=5 \Rightarrow 8y=5-2x$

Rearrange to make y the subject.

$\Rightarrow y=\frac{5}{8}-\frac{1}{4}x$

The gradient is $-\frac{1}{4}$

$4\times\left(-\frac{1}{4}\right)=-1$ so this line is perpendicular to $y=4x-1$

Since the product of the gradients is -1

b $20x+5y=2 \Rightarrow 5y=2-20x$

$\Rightarrow y=\frac{2}{5}-4x$

Rearrange to make y the subject.

The gradient is -4 so this line is neither parallel nor perpendicular to $y=4x-1$

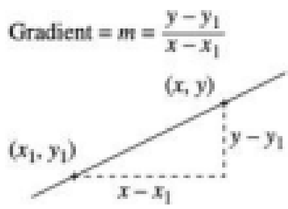
c $16x-4y=5 \Rightarrow 4y=16x-5$

$\Rightarrow y=4x-\frac{5}{4}$

The gradient is 4 so this line is parallel to $y=4x-1$

You can write the gradient of a line in terms of a known point on the line (x_1, y_1), the general point (x, y), and the gradient, m.

$m = \frac{y - y_1}{x - x_1}$ or alternatively $y - y_1 = m(x - x_1)$



Key point

The equation of the line with gradient m through the point (x_1, y_1) is $y - y_1 = m(x - x_1)$

Example 4

The line l_1 has equation $7x + 4y = 8$ The line l_2 is perpendicular to l_1 and passes through the point (7, 3). Find the equation of l_2 in the form $ax + by + c = 0$ where a, b and c are integers.

$l_1: 7x + 4y = 8 \Rightarrow 4y = -7x + 8$

$\Rightarrow y = -\frac{7}{4}x + 2$ — Rearrange to make y the subject so you can see what the gradient is.

So the gradient of l_1 is $-\frac{7}{4}$ and the gradient of l_2 is $\frac{4}{7}$ — Since $\left(-\frac{7}{4}\right) \times \frac{4}{7} = -1$

So the equation of l_2 is $y - 3 = \frac{4}{7}(x - 7)$ — Use $y - y_1 = m(x - x_1)$ to write the equation of l_2

$\Rightarrow 7y - 21 = 4(x - 7)$ — Multiply both sides by 7 so that all coefficients are integers.

$\Rightarrow 7y - 21 = 4x - 28$

$\Rightarrow 4x - 7y - 7 = 0$ — Rearrange to the correct form.

Quadratics

When factorising quadratics of the form $ax^2 + bx + c$ with $a \neq 1$, first split the bx term into two terms where the coefficients multiply to give the same value as $a \times c$

Example 1

Factorise each of these quadratics.

a $3x^2 + 11x + 6$ **b** $2x^2 - 9x + 10$

a $3x^2 + 11x + 6 = 3x^2 + 9x + 2x + 6$ — Split $11x$ into $9x + 2x$ since $9 \times 2 = 18$ and $3 \times 6 = 18$

$= 3x(x + 3) + 2(x + 3)$ — Factorise the first pair of terms and the second pair of terms.

$= (3x + 2)(x + 3)$

b $2x^2 - 9x + 10 = 2x^2 - 4x - 5x + 10$ — Split $9x$ into $-4x - 5x$ since $-4 \times -5 = 20$ and $2 \times 10 = 20$

$= 2x(x - 2) - 5(x - 2)$ — Factorise the first pair of terms and the second pair of terms.

$= (2x - 5)(x - 2)$

Example 2

Use factorisation to find the roots of these quadratic equations.

a $4x^2 + 12x = 0$ **b** $5x^2 = 21x - 4$

a $4x^2 + 12x = 4x(x+3)$ — Factorise the quadratic.

$4x(x+3) = 0 \Rightarrow 4x = 0$ or $x + 3 = 0$ — One of the factors must be equal to zero.

If $4x = 0$ then $x = 0$ and if $x + 3 = 0$ then $x = -3$ — Solve to find the roots.

b $5x^2 - 21x + 4 = 0$ — Rearrange so you have a quadratic expression equal to zero.

$5x^2 - 21x + 4 = 5x^2 - 20x - x + 4$ — Write $-21x = -x - 20x$ since $-20 \times -1 = 20$ and $5 \times 4 = 20$

$= 5x(x-4) - (x-4)$

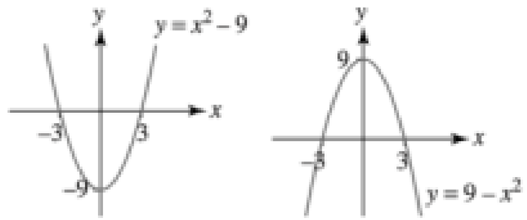
$= (5x-1)(x-4)$ — Factorise the quadratic.

$(5x-1)(x-4) = 0 \Rightarrow 5x - 1 = 0$ or $x - 4 = 0$ — The product is zero so one of the factors must be equal to zero.

If $5x - 1 = 0$ then $x = \frac{1}{5}$ and if $x - 4 = 0$ then $x = 4$ — Solve to find the roots.

A quadratic function has a **parabola** shaped curve.

When you sketch the graph of a quadratic function you must include the coordinates of the points where the curve crosses the x and y axes.



Example 3

Sketch these quadratic functions.

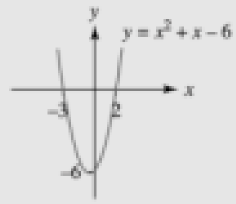
a $y = x^2 + x - 6$ **b** $y = -x^2 + 4x$

a When $x = 0$, $y = -6$ — Find the y-intercept by letting $x = 0$

When $y = 0$, $x^2 + x - 6 = 0$ — Find the x-intercept by letting $y = 0$

$x^2 + x - 6 = (x+3)(x-2)$ — Factorise to find the roots.

$(x+3)(x-2) = 0 \Rightarrow x = -3$ or $x = 2$



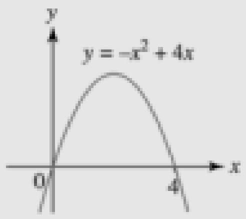
Sketch the parabola and label the y-intercept of –6 and the x-intercepts of –3 and 2

b When $x = 0$, $y = 0$ — Find the y-intercept by letting $x = 0$

When $y = 0$, $-x^2 + 4x = 0$ — Find the x-intercept by letting $y = 0$

$-x^2 + 4x = -x(x-4)$

$-x(x-4) = 0 \Rightarrow x = 0$ or $x = 4$ — Factorise to find the roots.



Sketch the parabola, it will be this way up since the x^2 term in the quadratic is negative. Label the x and y intercepts.

Key point

The completed square form of x^2+bx+c is $\left(x+\frac{b}{2}\right)^2-\left(\frac{b}{2}\right)^2+c$

If you have an expression of the form ax^2+bx+c then first factor out the a, as shown in Example 1

Example 1

Write each of these quadratics in the form $p(x+q)^2+r$ where p, q and r are constants to be found.

a x^2+6x+7 **b** $-2x^2+12x$

a $x^2+6x+7=\left(x+\frac{6}{2}\right)^2-\left(\frac{6}{2}\right)^2+7$

$=(x+3)^2-9+7$

$=(x+3)^2-2$

The constant term in the bracket will be half of the coefficient of x

b $-2x^2+12x=-2\left[x^2-6x\right]$

$=-2\left[(x-3)^2-9\right]$

$=-2(x-3)^2+18$

First factor out the coefficient of x^2 then complete the square for the expression in the square brackets.

Key point

The turning point on the curve with equation $y=p(x+q)^2+r$ has coordinates $(-q, r)$, this will be a minimum if p is positive and a maximum if p is negative.

Example 2

Find the coordinates of the turning point of the curve with equation $y=-x^2+5x-2$

$-x^2+5x-2=-\left[x^2-5x+2\right]$

First factor out the −1 then complete the square for the expression in the square brackets.

$=-\left[\left(x-\frac{5}{2}\right)^2-\frac{25}{4}+2\right]$

$=-\left[\left(x-\frac{5}{2}\right)^2-\frac{17}{4}\right]$

$=-\left(x-\frac{5}{2}\right)^2+\frac{17}{4}$

So the maximum point is at $\left(\frac{5}{2},\frac{17}{4}\right)$

The curve is at its highest point when the bracket is equal to zero: $x-\frac{5}{2}=0 \Rightarrow x=\frac{5}{2}$