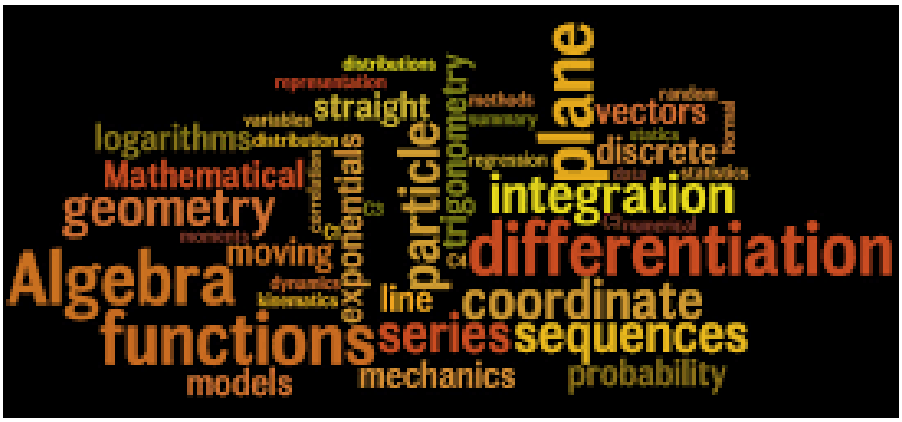
GETTING READY FOR A LEVEL MATHS



Congratulations on choosing A Level Maths…what an excellent choice!

The purpose of this induction task is to keep your mathematical knowledge ticking over, in particular those GCSE skills that you will be most useful for A Level.

We would also hate you to be bored during that extra long summer holiday you have!

Task:

Complete each topic task and mark your answers. If you are unsure about any topics, make sure you do a bit of revision using revision guides and/or the internet to help.

Complete the "Are You Ready?" assessment on paper and bring it to your first Maths lesson, along with the completed booklet.

Topic Checklist:

- Surds and Indices
- Expanding and factorising quadratics
- Completing the square
- Quadratic formula
- Simultaneous equations

SURDS

1 Evaluate

a $\sqrt{49}$ **b** $\sqrt{121}$ **c** $\sqrt{\frac{1}{9}}$ **d** $\sqrt{\frac{4}{25}}$ **e** $\sqrt{0.01}$ **f** $\sqrt{0.09}$

g $\sqrt[3]{8}$ **h** $\sqrt[3]{1000}$ **i** $\sqrt[4]{81}$ **j** $\sqrt{1\frac{9}{16}}$ **k** $\sqrt[3]{0.125}$ **l** $\sqrt[3]{15\frac{5}{8}}$

2 Simplify

a $\sqrt{7} \times \sqrt{7}$ **b** $4\sqrt{5} \times \sqrt{5}$ **c** $(3\sqrt{3})^2$ **d** $(\sqrt{6})^4$

e $(\sqrt{2})^5$ **f** $(2\sqrt{3})^3$ **g** $\sqrt{2} \times \sqrt{8}$ **h** $2\sqrt{3} \times \sqrt{27}$

i $\frac{\sqrt{32}}{\sqrt{2}}$ **j** $\frac{\sqrt{3}}{\sqrt{12}}$ **k** $(\sqrt[3]{6})^3$ **l** $(3\sqrt[3]{2})^3$

3 Express in the form $k\sqrt{2}$

a $\sqrt{18}$ **b** $\sqrt{50}$ **c** $\sqrt{8}$ **d** $\sqrt{98}$ **e** $\sqrt{200}$ **f** $\sqrt{162}$

8 Express each of the following as simply as possible with a rational denominator.

a $\frac{1}{\sqrt{5}}$ **b** $\frac{2}{\sqrt{3}}$ **c** $\frac{1}{\sqrt{8}}$ **d** $\frac{14}{\sqrt{7}}$ **e** $\frac{3\sqrt{2}}{\sqrt{3}}$ **f** $\frac{\sqrt{5}}{\sqrt{15}}$

12 Express each of the following as simply as possible with a rational denominator.

a $\frac{1}{\sqrt{2}+1}$ **b** $\frac{4}{\sqrt{3}-1}$ **c** $\frac{1}{\sqrt{6}-2}$ **d** $\frac{3}{2+\sqrt{3}}$

INDICES

1 Evaluate

a 8^2 **b** 6^3 **c** 7^0 **d** $(-5)^4$ **e** $(-3)^5$ **f** $(\frac{1}{2})^4$

g $(\frac{2}{3})^3$ **h** $(-\frac{1}{4})^3$ **i** $(1\frac{1}{3})^2$ **j** $(1\frac{1}{2})^4$ **k** $(0.1)^5$ **l** $(-0.2)^3$

2 Write in the form 2^n

a $2^5 \times 2^3$ **b** 2×2^6 **c** 1 **d** $2^6 \div 2^2$ **e** $2^{15} \div 2^6$ **f** $(2^7)^2$

3 Simplify

a $2p^2 \times 4p^5$ **b** $x^2 \times x^3 \times x^5$ **c** $12n^7 \div 2n^2$ **d** $(y^3)^4$

e $(2b)^3 \div 4b^2$ **f** $p^3q \times pq^2$ **g** $x^4y^3 \div xy^2$ **h** $2r^2s \times 3s^2$

i $6x^5y^8 \div 3x^2y$ **j** $6a^4b^5 \times \frac{2}{3}ab^3$ **k** $(5rs^2)^3 \div (10rs)^2$ **l** $3p^4q^3 \div \frac{1}{5}pq^2$

7 Simplify

a $x^8 \times x^{-6}$ **b** $y^{-2} \times y^{-4}$ **c** $6p^3 \div 2p^7$ **d** $(2x^{-4})^3$

e $y^3 \times y^{-\frac{1}{2}}$ **f** $2b^{\frac{2}{3}} \times 4b^{\frac{1}{4}}$ **g** $x^{\frac{3}{5}} \div x^{\frac{1}{3}}$ **h** $a^{\frac{1}{2}} \div a^{\frac{4}{3}}$

i $p^{\frac{1}{4}} \div p^{-\frac{1}{3}}$ **j** $(3x^{\frac{2}{3}})^2$ **k** $y \times y^{\frac{5}{6}} \times y^{-\frac{3}{2}}$ **l** $4t^{\frac{3}{2}} \div 12t^{\frac{1}{2}}$

m $\frac{b^2 \times b^{\frac{1}{4}}}{b^{\frac{1}{2}}}$ **n** $\frac{y^{\frac{1}{2}} \times y^{\frac{1}{3}}}{y}$ **o** $\frac{4x^{\frac{2}{3}} \times 3x^{-\frac{1}{6}}}{6x^{\frac{3}{4}}}$ **p** $\frac{2a \times a^{\frac{3}{4}}}{8a^{-\frac{1}{2}}}$

QUADRATICS

1 Factorise

a $x^2 + 4x + 3$ **b** $x^2 + 7x + 10$ **c** $y^2 - 3y + 2$ **d** $x^2 - 6x + 9$

e $y^2 - y - 2$ **f** $a^2 + 2a - 8$ **g** $x^2 - 1$ **h** $p^2 + 9p + 14$

2 Factorise

a $2x^2 + 3x + 1$ **b** $2 + 7p + 3p^2$ **c** $2y^2 - 5y + 3$ **d** $2 - m - m^2$

e $3r^2 - 2r - 1$ **f** $5 - 19y - 4y^2$ **g** $4 - 13a + 3a^2$ **h** $5x^2 - 8x - 4$

5 Sketch each curve showing the coordinates of any points of intersection with the coordinate axes.

a $y = x^2 - 3x + 2$ **b** $y = x^2 + 5x + 6$ **c** $y = x^2 - 9$

d $y = x^2 - 2x$ **e** $y = x^2 - 10x + 25$ **f** $y = 2x^2 - 14x + 20$

SOLVING QUADRATICS

3 Using factorisation, solve each equation.

a $x^2 - 4x + 3 = 0$ **b** $x^2 + 6x + 8 = 0$ **c** $x^2 + 4x - 5 = 0$ **d** $x^2 - 7x = 8$

e $x^2 - 25 = 0$ **f** $x(x - 1) = 42$ **g** $x^2 = 3x$ **h** $27 + 12x + x^2 = 0$

3 Solve each equation by completing the square, giving your answers as simply as possible in terms of surds where appropriate.

b $p^2 + 2p - 2 = 0$

f $a^2 - 12a - 18 = 0$

j $2y^2 - 4y + 1 = 0$

n $4x^2 + 49 = 28x$

5 Sketch each curve showing the exact coordinates of its turning point and the point where it crosses the y-axis.

a $y = x^2 - 4x + 3$ **b** $y = x^2 + 2x - 24$ **c** $y = x^2 - 2x + 5$

2 Use the quadratic formula to solve each equation, giving your answers as simply as possible in terms of surds where appropriate.

a $x^2 + 4x + 1 = 0$ **b** $4 + 8t - t^2 = 0$ **c** $y^2 - 20y + 91 = 0$ **d** $r^2 + 2r - 7 = 0$

e $6 + 18a + a^2 = 0$ **f** $m(m - 5) = 5$ **g** $x^2 + 11x + 27 = 0$ **h** $2u^2 + 6u + 3 = 0$

SIMULTANEOUS EQUATIONS

1 Solve each pair of simultaneous equations.

a $y = 3x$
$y = 2x + 1$

b $y = x - 6$
$y = \frac{1}{2}x - 4$

c $y = 2x + 6$
$y = 3 - 4x$

d $x + y - 3 = 0$
$x + 2y + 1 = 0$

e $x + 2y + 11 = 0$
$2x - 3y + 1 = 0$

f $3x + 3y + 4 = 0$
$5x - 2y - 5 = 0$

2 Find the coordinates of the points of intersection of the given straight line and curve in each case.

a $y = x + 2$
$y = x^2 - 4$

b $y = 4x + 11$
$y = x^2 + 3x - 1$

c $y = 2x - 1$
$y = 2x^2 + 3x - 7$

ANSWERS: SURDS

1 **a** $=7$ **b** $=11$ **c** $=\frac{1}{3}$

d $=\frac{2}{5}$ **e** $=0.1$ **f** $=0.3$

g $=2$ **h** $=10$ **i** $=3$

j $=\sqrt{\frac{25}{16}}=\frac{5}{4}$ or $1\frac{1}{4}$ **k** $=\sqrt[3]{\frac{1}{8}}=\frac{1}{2}$ or 0.5 **l** $=\sqrt[3]{\frac{125}{8}}=\frac{5}{2}$ or $2\frac{1}{2}$

2 **a** $=7$ **b** $=20$ **c** $=27$ **d** $=36$

e $=4\sqrt{2}$ **f** $=24\sqrt{3}$ **g** $=\sqrt{16}=4$ **h** $=2\sqrt{81}=18$

i $=\sqrt{16}=4$ **j** $=\sqrt{\frac{1}{4}}=\frac{1}{2}$ **k** $=6$ **l** $=54$

3 **a** $=\sqrt{9}\times\sqrt{2}=3\sqrt{2}$ **b** $=\sqrt{25}\times\sqrt{2}=5\sqrt{2}$ **c** $=\sqrt{4}\times\sqrt{2}=2\sqrt{2}$

d $=\sqrt{49}\times\sqrt{2}=7\sqrt{2}$ **e** $=\sqrt{100}\times\sqrt{2}=10\sqrt{2}$ **f** $=\sqrt{81}\times\sqrt{2}=9\sqrt{2}$

8 **a** $=\frac{1}{\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}}=\frac{1}{5}\sqrt{5}$ **b** $=\frac{2}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}=\frac{2}{3}\sqrt{3}$ **c** $=\frac{1}{2\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}=\frac{1}{4}\sqrt{2}$

d $=\frac{14}{\sqrt{7}}\times\frac{\sqrt{7}}{\sqrt{7}}=2\sqrt{7}$ **e** $=\frac{3\sqrt{2}}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}=\sqrt{6}$ **f** $=\frac{\sqrt{5}}{\sqrt{3}\sqrt{5}}=\frac{1}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}=\frac{1}{3}\sqrt{3}$

12 **a** $=\frac{1}{\sqrt{2}+1}\times\frac{\sqrt{2}-1}{\sqrt{2}-1}=\frac{\sqrt{2}-1}{2-1}=\sqrt{2}-1$

b $=\frac{4}{\sqrt{3}-1}\times\frac{\sqrt{3}+1}{\sqrt{3}+1}=\frac{4(\sqrt{3}+1)}{3-1}=2(\sqrt{3}+1)$

c $=\frac{1}{\sqrt{6}-2}\times\frac{\sqrt{6}+2}{\sqrt{6}+2}=\frac{\sqrt{6}+2}{6-4}=\frac{1}{2}(\sqrt{6}+2)$ or $\frac{1}{2}\sqrt{6}+1$

d $=\frac{3}{2+\sqrt{3}}\times\frac{2-\sqrt{3}}{2-\sqrt{3}}=\frac{3(2-\sqrt{3})}{4-3}=3(2-\sqrt{3})$

ANSWERS: INDICES

1 **a** $= 64$ **b** $= 216$ **c** $= 1$

d $= 625$ **e** $= -243$ **f** $= \frac{1}{16}$

g $= \frac{8}{27}$ **h** $= -\frac{1}{64}$ **i** $= (\frac{4}{3})^2 = \frac{16}{9}$ or $1\frac{7}{9}$

j $= (\frac{3}{2})^4 = \frac{81}{16}$ or $5\frac{1}{16}$ **k** $= 0.000\,01$ **l** $= -0.008$

2 **a** 2^8 **b** 2^7 **c** 2^0 **d** 2^4 **e** 2^9 **f** 2^{14}

3 **a** $= 8p^7$ **b** $= x^{10}$ **c** $= 6n^5$ **d** $= y^{12}$

e $= 2b$ **f** $= p^4q^3$ **g** $= x^3y$ **h** $= 6r^2s^3$

i $= 2x^3y^7$ **j** $= 4a^5b^8$ **k** $= 125r^3s^6 \div 100r^2s^2$ **l** $= 15p^3q$

$= \frac{5}{4}rs^4$

7 **a** $= x^2$ **b** $= y^{-6}$ **c** $= 3p^{-4}$ **d** $= 8x^{-12}$

e $= y^{\frac{5}{2}}$ **f** $= 8b^{\frac{2}{3}+\frac{1}{4}} = 8b^{\frac{11}{12}}$ **g** $= x^{\frac{3}{5}-\frac{1}{3}} = x^{\frac{4}{15}}$ **h** $= a^{\frac{1}{2}-\frac{4}{3}} = a^{-\frac{5}{6}}$

i $= p^{\frac{1}{4}-(-\frac{1}{5})} = p^{\frac{9}{20}}$ **j** $= 9x^{\frac{4}{3}}$ **k** $= y^{1+\frac{5}{6}-\frac{3}{2}} = y^{\frac{1}{3}}$ **l** $= \frac{1}{3}t$

m $= b^{2+\frac{1}{4}-\frac{1}{2}} = b^{\frac{7}{4}}$ **n** $= y^{\frac{1}{2}+\frac{1}{3}-1} = y^{-\frac{1}{6}}$ **o** $= 2x^{\frac{2}{3}+(-\frac{1}{6})-\frac{3}{4}} = 2x^{-\frac{1}{4}}$ **p** $= \frac{1}{4}a^{1+\frac{3}{4}-(-\frac{1}{2})} = \frac{1}{4}a^{\frac{9}{4}}$

ANSWERS: QUADRATICS

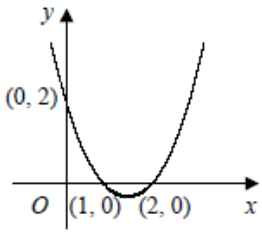
1 **a** $(x+1)(x+3)$ **b** $(x+2)(x+5)$ **c** $(y-1)(y-2)$ **d** $(x-3)^2$

e $(y+1)(y-2)$ **f** $(a+4)(a-2)$ **g** $(x+1)(x-1)$ **h** $(p+2)(p+7)$

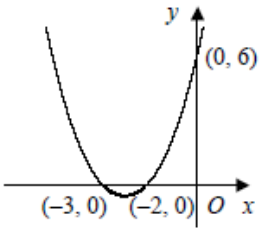
2 **a** $(2x+1)(x+1)$ **b** $(3p+1)(p+2)$ **c** $(2y-3)(y-1)$ **d** $(2+m)(1-m)$

e $(3r+1)(r-1)$ **f** $(5+y)(1-4y)$ **g** $(3a-1)(a-4)$ **h** $(5x+2)(x-2)$

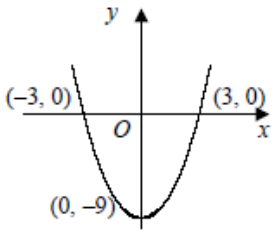
5 **a** $x^2-3x+2=0$
$(x-1)(x-2)=0$
$x=1$ or 2



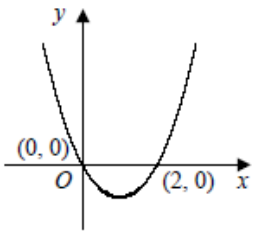
b $x^2+5x+6=0$
$(x+3)(x+2)=0$
$x=-3$ or -2



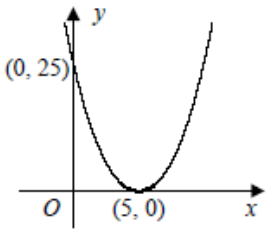
c $x^2-9=0$
$(x+3)(x-3)=0$
$x=-3$ or 3



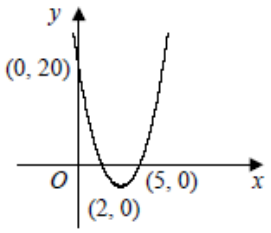
d $x^2-2x=0$
$x(x-2)=0$
$x=0$ or 2



e $x^2-10x+25=0$
$(x-5)^2=0$
$x=5$



f $2x^2-14x+20=0$
$2(x-2)(x-5)=0$
$x=2$ or 5



ANSWERS: SOLVING QUADRATICS

3 **a** $(x-1)(x-3)=0$
$x=1$ or 3

b $(x+4)(x+2)=0$
$x=-4$ or -2

c $(x+5)(x-1)=0$
$x=-5$ or 1

d $x^2-7x-8=0$
$(x+1)(x-8)=0$
$x=-1$ or 8

e $(x+5)(x-5)=0$
$x=-5$ or 5

f $x^2-x-42=0$
$(x+6)(x-7)=0$
$x=-6$ or 7

g $x^2-3x=0$
$x(x-3)=0$
$x=0$ or 3

h $(x+9)(x+3)=0$
$x=-9$ or -3

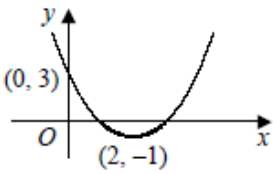
b $(p+1)^2-1-2=0$
$(p+1)^2=3$
$p+1=\pm\sqrt{3}$
$p=-1\pm\sqrt{3}$

f $(a-6)^2-36-18=0$
$(a-6)^2=54$
$a-6=\pm\sqrt{54}=\pm3\sqrt{6}$
$a=6\pm3\sqrt{6}$

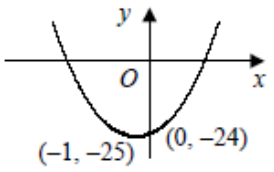
j $y^2-2y+\frac{1}{2}=0$
$(y-1)^2-1+\frac{1}{2}=0$
$(y-1)^2=\frac{1}{2}$
$y-1=\pm\frac{1}{\sqrt{2}}=\pm\frac{1}{2}\sqrt{2}$
$y=1\pm\frac{1}{2}\sqrt{2}$

n $4x^2-28x+49=0$
$x^2-7x+\frac{49}{4}=0$
$(x-\frac{7}{2})^2-\frac{49}{4}+\frac{49}{4}=0$
$(x-\frac{7}{2})^2=0$
$x=\frac{7}{2}$

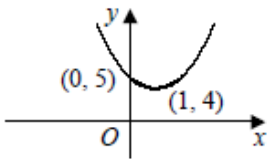
5 **a** $y=(x-2)^2-4+3$
$y=(x-2)^2-1$
minimum $(2,-1)$



b $y=(x+1)^2-1-24$
$y=(x+1)^2-25$
minimum $(-1,-25)$



c $y=(x-1)^2-1+5$
$y=(x-1)^2+4$
minimum $(1,4)$



2 **a** $x=\frac{-4\pm\sqrt{16-4}}{2}$
$x=\frac{-4\pm2\sqrt{3}}{2}$
$x=-2\pm\sqrt{3}$

b $t=\frac{-8\pm\sqrt{64+16}}{-2}$
$t=\frac{-8\pm4\sqrt{5}}{-2}$
$t=4\pm2\sqrt{5}$

c $y=\frac{20\pm\sqrt{400-364}}{2}$
$y=\frac{20\pm6}{2}$
$y=7$ or 13

d $r=\frac{-2\pm\sqrt{4+28}}{2}$
$r=\frac{-2\pm4\sqrt{2}}{2}$
$r=-1\pm2\sqrt{2}$

e $a=\frac{-18\pm\sqrt{324-24}}{2}$
$a=\frac{-18\pm10\sqrt{3}}{2}$
$a=-9\pm5\sqrt{3}$

f $m^2-5m-5=0$
$m=\frac{5\pm\sqrt{25+20}}{2}$
$m=\frac{1}{2}(5\pm3\sqrt{5})$

g $x=\frac{-11\pm\sqrt{121-108}}{2}$
$x=\frac{1}{2}(-11\pm\sqrt{13})$

h $u=\frac{-6\pm\sqrt{36-24}}{4}$
$u=\frac{-6\pm2\sqrt{3}}{4}$
$u=\frac{1}{2}(-3\pm\sqrt{3})$

ANSWERS: SIMULTANEOUS EQUATIONS

1 **a** $3x = 2x + 1$

$x = 1$

$\therefore\ x = 1, y = 3$

b $x - 6 = \frac{1}{2}x - 4$

$x = 4$

$\therefore\ x = 4, y = -2$

c $2x + 6 = 3 - 4x$

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

$\therefore\ x = -\frac{1}{2}, y = 5$

d subtracting

$y + 4 = 0$

$y = -4$

$\therefore\ x = 7, y = -4$

e $2x + 4y + 22 = 0$

$2x - 3y + 1 = 0$

subtracting

$7y + 21 = 0$

$y = -3$

$\therefore\ x = -5, y = -3$

f $6x + 6y + 8 = 0$

$15x - 6y - 15 = 0$

adding

$21x - 7 = 0$

$x = \frac{1}{3}$

$\therefore\ x = \frac{1}{3}, y = -\frac{5}{3}$

2 **a** $x + 2 = x^2 - 4$

$x^2 - x - 6 = 0$

$(x + 2)(x - 3) = 0$

$x = -2$ or 3

$\therefore$ $(-2, 0)$ and $(3, 5)$

b $4x + 11 = x^2 + 3x - 1$

$x^2 - x - 12 = 0$

$(x + 3)(x - 4) = 0$

$x = -3$ or 4

$\therefore$ $(-3, -1)$ and $(4, 27)$

c $2x - 1 = 2x^2 + 3x - 7$

$2x^2 + x - 6 = 0$

$(2x - 3)(x + 2) = 0$

$x = -2$ or $\frac{3}{2}$

$\therefore$ $(-2, -5)$ and $(\frac{3}{2}, 2)$

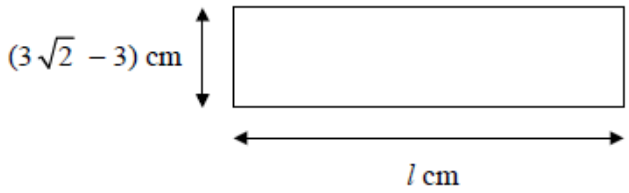
ARE YOU READY?

Complete on paper and hand in to your Maths teacher in your first lesson.

You will find some this challenging – don't worry!

Try your best and give each question a go – we just want to see what you can do.

1.



The diagram shows a rectangle measuring $(3\sqrt{2} - 3)$ cm by l cm.
Given that the area of the rectangle is 6 cm^2, find the exact value of l in its simplest form.

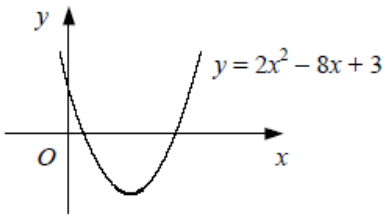
2. Given that $x = 2^{t-1}$ and $y = 2^{3t}$,

a find expressions in terms of t for

i xy **ii** $2y^2$

3. Solve $x - 5 + \frac{4}{x} = 0$

4.



The diagram shows the curve with equation $y = 2x^2 - 8x + 3$.
Find and simplify the exact coordinates of the points where the curve crosses the x-axis.

5. **a** Express $x^2 - 4\sqrt{2}x + 5$ in the form $a(x + b)^2 + c$.

b Write down an equation of the line of symmetry of the curve $y = x^2 + 4\sqrt{2}x + 5$.

6. The line $y = 5 - x$ intersects the curve $y = x^2 - 3x + 2$ at the points P and Q.
Find the length PQ in the form $k\sqrt{2}$.