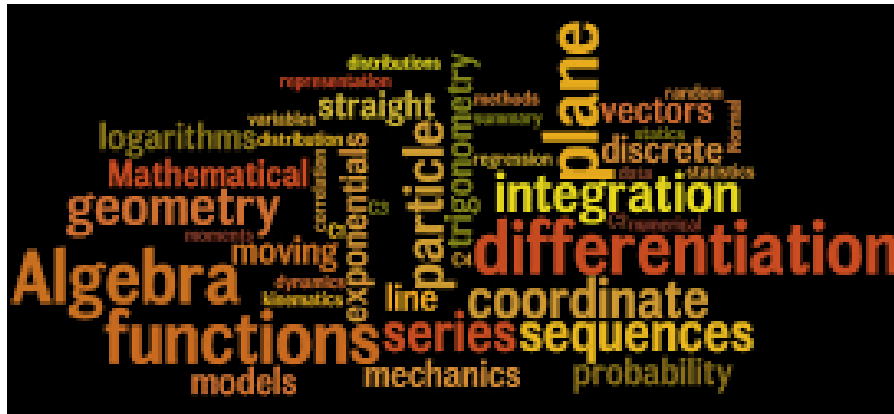


# Getting ready for A Level Maths



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

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

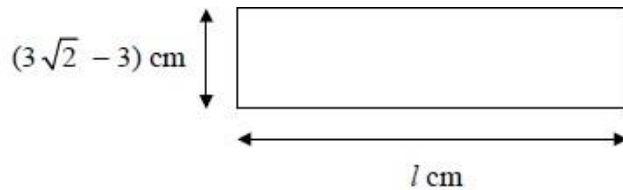
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1.



The diagram shows a rectangle measuring  $(3\sqrt{2} - 3)$  cm by  $l$  cm.

Given that the area of the rectangle is  $6 \text{ cm}^2$ , 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

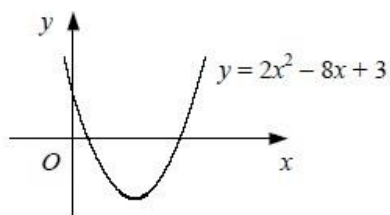
i  $xy$

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  $k\sqrt{2}$ .

## ANSWERS: surds

- 1**
- |   |   |  |
|---|---|--|
| <b>a</b> = 7  | <b>b</b> = 11   | <b>c</b> = $\frac{1}{3}$   |
| <b>d</b> = $\frac{2}{5}$  | <b>e</b> = 0.1  | <b>f</b> = 0.3   |
| <b>g</b> = 2  | <b>h</b> = 10   | <b>i</b> = 3   |
| <b>j</b> = $\sqrt{\frac{25}{16}} = \frac{5}{4}$ or $1\frac{1}{4}$ | <b>k</b> = $\sqrt[3]{\frac{1}{8}} = \frac{1}{2}$ or 0.5 | <b>l</b> = $\sqrt[3]{\frac{125}{8}} = \frac{5}{2}$ or $2\frac{1}{2}$ |
- 
- 2**
- |                            |   |                            |                              |
|----------------------------|---|----------------------------|------------------------------|
| <b>a</b> = 7               | <b>b</b> = 20                                 | <b>c</b> = 27              | <b>d</b> = 36                |
| <b>e</b> = $4\sqrt{2}$     | <b>f</b> = $24\sqrt{3}$                       | <b>g</b> = $\sqrt{16} = 4$ | <b>h</b> = $2\sqrt{81} = 18$ |
| <b>i</b> = $\sqrt{16} = 4$ | <b>j</b> = $\sqrt{\frac{1}{4}} = \frac{1}{2}$ | <b>k</b> = 6               | <b>l</b> = 54                |
- 
- 3**
- |  |  |  |
|--|--|--|
| <b>a</b> = $\sqrt{9} \times \sqrt{2} = 3\sqrt{2}$  | <b>b</b> = $\sqrt{25} \times \sqrt{2} = 5\sqrt{2}$   | <b>c</b> = $\sqrt{4} \times \sqrt{2} = 2\sqrt{2}$  |
| <b>d</b> = $\sqrt{49} \times \sqrt{2} = 7\sqrt{2}$ | <b>e</b> = $\sqrt{100} \times \sqrt{2} = 10\sqrt{2}$ | <b>f</b> = $\sqrt{81} \times \sqrt{2} = 9\sqrt{2}$ |
- 
- 8**
- |  |  |  |
|--|--|--|
| <b>a</b> = $\frac{1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{1}{5}\sqrt{5}$ | <b>b</b> = $\frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2}{3}\sqrt{3}$ | <b>c</b> = $\frac{1}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{1}{4}\sqrt{2}$                                    |
| <b>d</b> = $\frac{14}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = 2\sqrt{7}$          | <b>e</b> = $\frac{3\sqrt{2}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \sqrt{6}$    | <b>f</b> = $\frac{\sqrt{5}}{\sqrt{3}\sqrt{5}} = \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{1}{3}\sqrt{3}$ |
- 
- 12**
- |  |
|--|
| <b>a</b> = $\frac{1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} = \frac{\sqrt{2}-1}{2-1} = \sqrt{2}-1$   |
| <b>b</b> = $\frac{4}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{4(\sqrt{3}+1)}{3-1} = 2(\sqrt{3}+1)$                                   |
| <b>c</b> = $\frac{1}{\sqrt{6}-2} \times \frac{\sqrt{6}+2}{\sqrt{6}+2} = \frac{\sqrt{6}+2}{6-4} = \frac{1}{2}(\sqrt{6}+2)$ or $\frac{1}{2}\sqrt{6}+1$ |
| <b>d</b> = $\frac{3}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}} = \frac{3(2-\sqrt{3})}{4-3} = 3(2-\sqrt{3})$                                   |



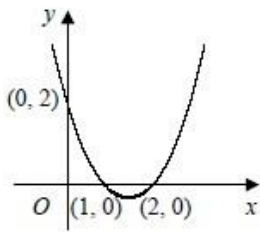


## ANSWERS: QUADRATICS

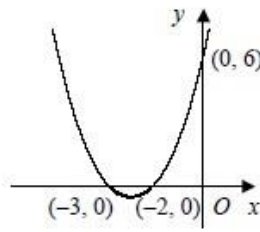
1    **a**  $(x+1)(x+3)$     **b**  $(x+2)(x+5)$     **c**  $(y-1)(y-2)$     **d**  $(x-3)^2$   
       **e**  $(y+1)(y-2)$     **f**  $(a+4)(a-2)$     **g**  $(x+1)(x-1)$     **h**  $(p+2)(p+7)$

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**  $(5x+2)(x-2)$

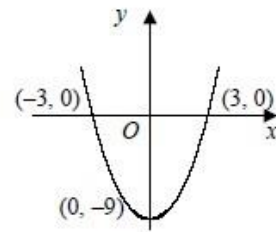
5    **a**  $x^2 - 3x + 2 = 0$   
 $(x-1)(x-2) = 0$   
 $x = 1$  or  $2$



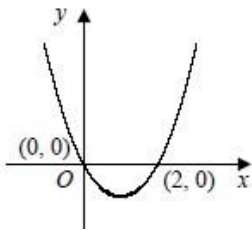
**b**  $x^2 + 5x + 6 = 0$   
 $(x+3)(x+2) = 0$   
 $x = -3$  or  $-2$



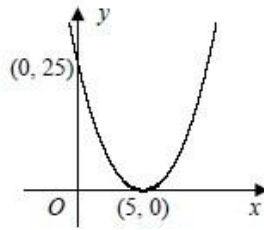
**c**  $x^2 - 9 = 0$   
 $(x+3)(x-3) = 0$   
 $x = -3$  or  $3$



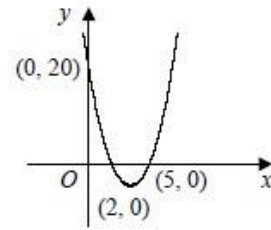
**d**  $x^2 - 2x = 0$   
 $x(x-2) = 0$   
 $x = 0$  or  $2$



**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  $5$

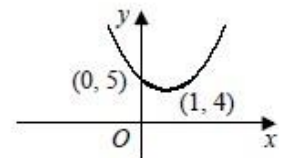
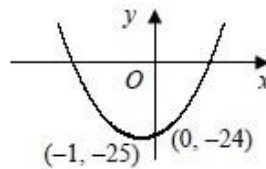
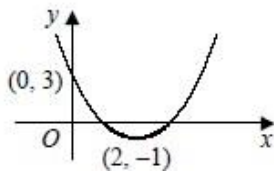


## ANSWERS: SOLVING QUADRATICS

- 3    a  $(x-1)(x-3) = 0$     b  $(x+4)(x+2) = 0$     c  $(x+5)(x-1) = 0$     d  $x^2 - 7x - 8 = 0$   
 $x = 1$  or  $3$      $x = -4$  or  $-2$      $x = -5$  or  $1$      $(x+1)(x-8) = 0$   
 $x = -1$  or  $8$
- e  $(x+5)(x-5) = 0$     f  $x^2 - x - 42 = 0$     g  $x^2 - 3x = 0$     h  $(x+9)(x+3) = 0$   
 $x = -5$  or  $5$      $(x+6)(x-7) = 0$      $x(x-3) = 0$      $x = -9$  or  $-3$   
 $x = -6$  or  $7$      $x = 0$  or  $3$

- b  $(p+1)^2 - 1 - 2 = 0$     j  $y^2 - 2y + \frac{1}{2} = 0$   
 $(p+1)^2 = 3$      $(y-1)^2 - 1 + \frac{1}{2} = 0$   
 $p+1 = \pm\sqrt{3}$      $(y-1)^2 = \frac{1}{2}$   
 $p = -1 \pm \sqrt{3}$      $y-1 = \pm\frac{1}{\sqrt{2}} = \pm\frac{1}{2}\sqrt{2}$   
 $y = 1 \pm \frac{1}{2}\sqrt{2}$
- f  $(a-6)^2 - 36 - 18 = 0$     n  $4x^2 - 28x + 49 = 0$   
 $(a-6)^2 = 54$      $x^2 - 7x + \frac{49}{4} = 0$   
 $a-6 = \pm\sqrt{54} = \pm 3\sqrt{6}$      $(x-\frac{7}{2})^2 - \frac{49}{4} + \frac{49}{4} = 0$   
 $a = 6 \pm 3\sqrt{6}$      $(x-\frac{7}{2})^2 = 0$   
 $x = \frac{7}{2}$

- 5    a  $y = (x-2)^2 - 4 + 3$     b  $y = (x+1)^2 - 1 - 24$     c  $y = (x-1)^2 - 1 + 5$   
 $y = (x-2)^2 - 1$      $y = (x+1)^2 - 25$      $y = (x-1)^2 + 4$   
 minimum  $(2, -1)$     minimum  $(-1, -25)$     minimum  $(1, 4)$



- 2    a  $x = \frac{-4 \pm \sqrt{16-4}}{2}$     b  $t = \frac{-8 \pm \sqrt{64+16}}{-2}$     c  $y = \frac{20 \pm \sqrt{400-364}}{2}$     d  $r = \frac{-2 \pm \sqrt{4+28}}{2}$   
 $x = \frac{-4 \pm 2\sqrt{3}}{2}$      $t = \frac{-8 \pm 4\sqrt{5}}{-2}$      $y = \frac{20 \pm 6}{2}$      $r = \frac{-2 \pm 4\sqrt{2}}{2}$   
 $x = -2 \pm \sqrt{3}$      $t = 4 \pm 2\sqrt{5}$      $y = 7$  or  $13$      $r = -1 \pm 2\sqrt{2}$
- e  $a = \frac{-18 \pm \sqrt{324-24}}{2}$     f  $m^2 - 5m - 5 = 0$     g  $x = \frac{-11 \pm \sqrt{121-108}}{2}$     h  $u = \frac{-6 \pm \sqrt{36-24}}{4}$   
 $a = \frac{-18 \pm 10\sqrt{3}}{2}$      $m = \frac{5 \pm \sqrt{25+20}}{2}$      $x = \frac{1}{2}(-11 \pm \sqrt{13})$      $u = \frac{-6 \pm 2\sqrt{3}}{4}$   
 $a = -9 \pm 5\sqrt{3}$      $m = \frac{1}{2}(5 \pm 3\sqrt{5})$      $u = \frac{1}{2}(-3 \pm \sqrt{3})$

## 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  $(\frac{3}{2}, 2)$

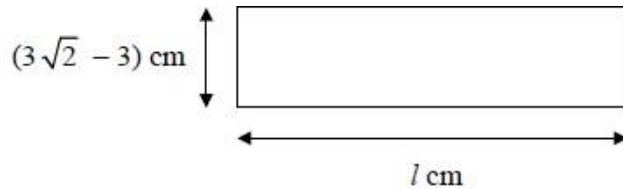
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The diagram shows a rectangle measuring  $(3\sqrt{2} - 3)$  cm by  $l$  cm.

Given that the area of the rectangle is  $6 \text{ cm}^2$ , 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

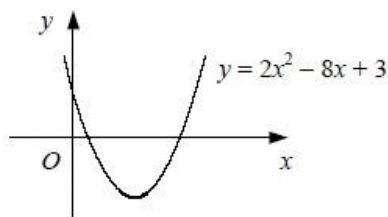
i  $xy$

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  $k\sqrt{2}$ .