

GCSE to A-Level bridging pack

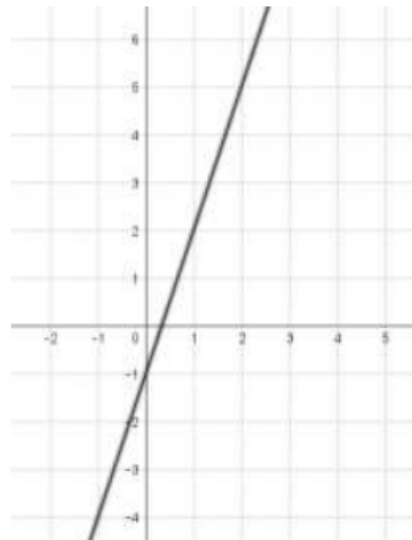
Section 1: Sketching



Linear Graphs 1



1. What are the gradient and intercept of the line $y = 3x - 5$?
2. Find the gradient of the line connecting $(3,10)$ and $(1,6)$
3. Find the midpoint between the points $(3,-8)$ and $(-1,4)$
4. Find the distance between points $(1,10)$ and $(4,18)$
5. What is the equation of the line with gradient 3 that passes through $(5,8)$?
6. Does the line $y = 2x - 3$ pass through $(1,-1)$? Explain how you know.
7. Find the equation of a line that is parallel to $y = 5x - 2$ that passes through $(2,19)$
8. What is the equation of this graph?



Sketching Linear Inequalities



Sketch and shade the following inequalities.

1. $y \leq 6$

2. $x < 6$

3. $x + 2y \geq 8$

4. $3x + 2y \geq 12$

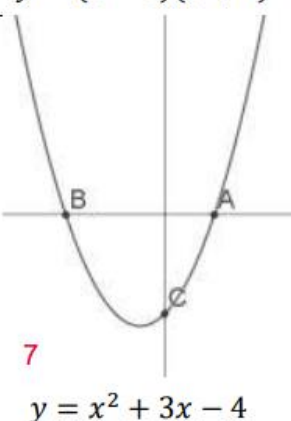
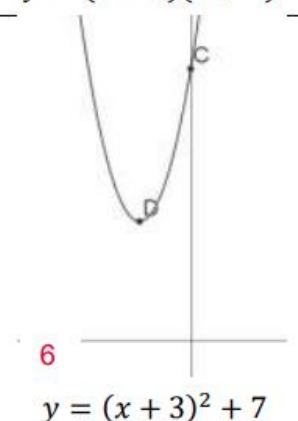
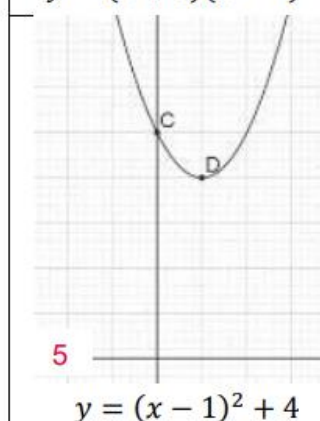
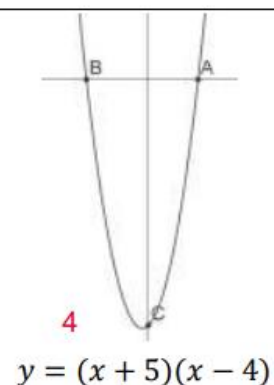
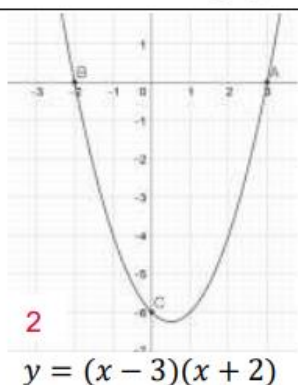
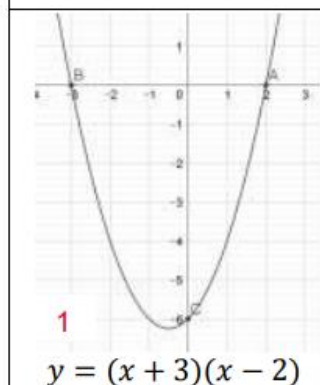
- Shade out the side of the line that doesn't satisfy the inequality.
- Label the correct region **R**



Quadratic Graphs 1



Find the coordinates of A, B and C on each graph

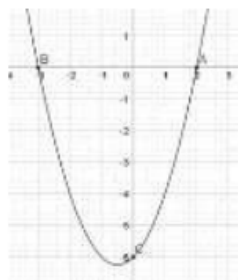


Quadratic Graphs 2

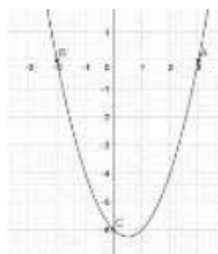


1. What are the x intercepts of $y = (2x + 3)(x + 4)$?

2. What are the x and y intercepts of this graph.



3. Write the equation of the graph in the form $ax^2 + bx + c$



4. What are the x intercepts of the graph of $y = 6x^2 + x - 2$?

5. What does the c part of the equation in $y = ax^2 + bx + c$ represent on a graph?

6. Sketch the graph of $y = 3x^2 - 2x - 8$. Label the x and y intercepts

7. What are the coordinates of the points marked on the diagram of the equation $y = x^2 + 6x + 16$?



8. Which of these statements about the graph $y = x^2 - 4x + 8$ are true

Has a minimum point at (2, 4)

Will not cross the x axis twice

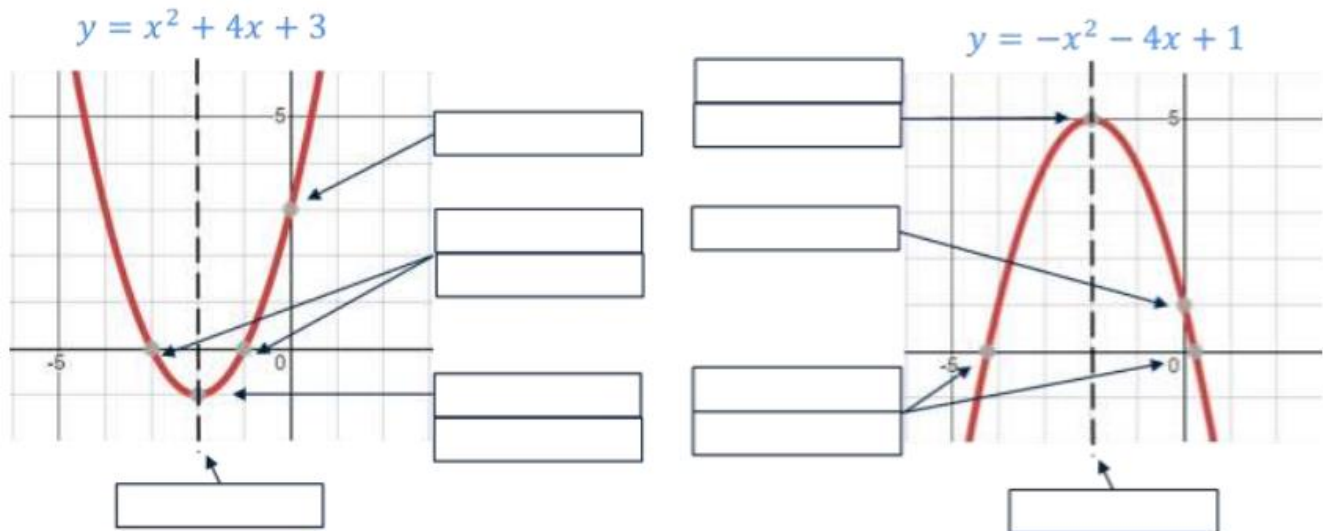
Can be factorised



What is a sketch?

In mathematics a sketch does not need to be a completely accurate drawing, but it should
“illustrate all the significant features of the graph/shape”

These diagrams show the key features of a quadratic graph



Put the words below into the boxes above so that the quadratic graphs are labelled correctly. Some words may be used more than once.

x intercepts

minimum

roots

turning point

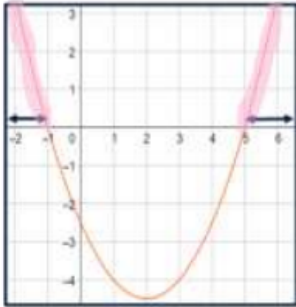
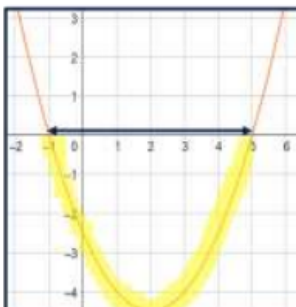
maximum

axis of symmetry

y intercept



Inequalities reminder

<p>Solve the inequality $x^2 - 4x - 5 \geq 0$</p> <p>Rearrange into factorised form...</p> $(x - 5)(x + 1) \geq 0$ <p>...now you can sketch the graph</p>  <p>When $x < -1$ and $x > 5$ the curve is above the x axis.</p> <p>This is where $x^2 - 4x - 5 \geq 0$</p> <p>These are two regions, so are represented by two inequalities</p> $x < -1 \text{ and } x > 5$	<p>Solve the inequality $x^2 - 4x - 5 < 0$</p> <p>Rearrange into factorised form...</p> $(x - 5)(x + 1) < 0$ <p>...now you can sketch the graph</p>  <p>When $x > -1$ and $x < 5$ the curve is below the x axis.</p> <p>This is where $x^2 - 4x - 5 < 0$</p> <p>This is one region, so can be represented by one inequality</p> $-1 < x < 5$
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Quadratic Inequalities

■ Use a sketch to help you solve the following inequalities

1. $(x - 2)(x + 3) < 0$

3. $x^2 + 7x + 12 \geq 0$

2. $(4 + x)(2 - x) < 0$

4. $36 \geq (x + 2)^2$



Sketching Other Graphs 1



1. What is the mathematical name for the graph of $y = \frac{1}{x}$?
2. What are the maximum and minimum values for the graph $y = \cos \theta$?
3. Sketch the graph of $y = 2^x$. Label the y and x intercepts.
4. Using a sketch of the graphs $y = \frac{1}{x}$ and $y = x$

Show how many solutions there will be to the equation $\frac{1}{x} = x$

5. What is the name for this type of graph?
6. What is the y intercept of the graph $y = (x + 2)(x - 3)(x + 5)$?
7. What are the x intercepts of the graph $y = (x + 2)(x - 3)(x + 5)$?
8. Sketch the graph of $y = (x - 3)(x + 2)(x + 5)$

Section 2: Simplifying



Fractions 1



1. What is the value of $\frac{2006}{8} + \frac{6002}{8}$

2. There are 84 animals in a field
11 are cows
45 are sheep
The rest are pigs

What fraction of the animals are pigs? Give your answer in simplest form

3. Simplify fully $\frac{x}{6} + \frac{3x}{4}$

4. Calculate $\frac{5}{6} \times \frac{3}{5}$

give your answer in simplest form

5. What is the value of

6. How many of these calculations equal 1
Give reasons

$$\frac{1}{2} + \frac{1}{2}$$

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

$$\frac{1}{2} \times \frac{1}{2}$$

$$\frac{1}{2} \div \frac{1}{2}$$

7. Sally has 30m of ribbon.
She cuts lengths of $2\frac{3}{5}$ metres from the ribbon. Sally says she has enough ribbon to cut 12 lengths. Is she correct? You must show all workings

8. Express as a single fraction $\frac{2a}{3} - \frac{b}{4}$



Indices 2



Simplify the following

1. $t^5 \times t^4 =$

5. $(8)^{\frac{1}{3}} =$

2. $\frac{8^7}{8^2} =$

6. $y^0 =$

3. $(3^4)^2 =$

7. What is $4^{-3} =$

4. $\frac{5^7 \times 5}{(5^3)^3} =$

8. What is $\left(\frac{2}{3}\right)^{-2} =$



Surds 1



1. Simplify $\sqrt{a} + 2\sqrt{a} + 5\sqrt{a}$

5. Calculate $\frac{\sqrt{54}}{\sqrt{6}}$

2. Simplify $\sqrt{2} \times \sqrt{6}$

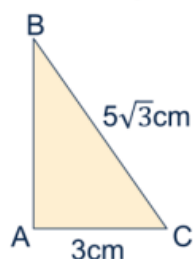
6. Rationalise the denominator of $\frac{4}{\sqrt{3}}$

3. Simplify fully $(4\sqrt{3})^2$

7. A rectangle has an area of $8\sqrt{15} \text{ cm}^2$ and a length of $2\sqrt{3} \text{ cm}$. Find the width of the rectangle

4. Write $\sqrt{45} + \sqrt{20}$ in the form $k\sqrt{5}$

8. Find the length AB



Section 3: Expanding



Expanding 2



1. Expand $y(2y - 3)$

5. Multiply the expressions y and $y + 4$

Which of these expressions show the result?

2. Expand $2x^2(3xy - 2x^3)$

$5y$

$y(y + 4)$

$y^2 + 4y$

$4y + 4$

3. Expand and simplify

a. $5(x - 4) + 3(2x + 5)$

6. A rectangle of width 3cm and width $x + 4 \text{ cm}$ is made larger by doubling its side lengths. What is the area, in cm^2 of the larger rectangle?

4. Expand and simplify

a. $4(\sqrt{2} - 3) + 2(\sqrt{2} + 2)$

7. Expand and simplify $4 - 3(2 - a + t) - t$

8. Expand and simplify

$\frac{a}{2}\left(3 + \frac{a}{4}\right) + \frac{a}{3}\left(2 + \frac{a}{2}\right)$



Expanding 1



1. Without doing the calculation, will the answer to this calculation be positive or negative? Give a reason.

a. $2 \times (-3) \times (-4) \times 6 \times (-6) \times (-1) \times 7 \times (-2)$

2. 24×17 is the same as which of the following

$2 \times 3 \times 17 \times 2 \times 2$

$(20 + 4)(10 + 7)$

$(30 - 5)(20 - 2)$

$20(10 + 7) + 4(10 + 7)$

3. Expand $3(\sqrt{3} - 6)$

4. Expand and simplify

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

5. Expand and simplify

a. $(x + 6)(x - 2)$

6. Expand and simplify

a. $(\sqrt{2} + 3)(\sqrt{2} + 1)$

7. Expand and simplify

a. $(x^2 + 2)(x^2 + 6)$

8. Expand and simplify

a. $(x^2 + 3)(x^3 + 7)$



Summary and review



1. Expand and simplify

$\left(\frac{1}{3}x + \frac{1}{9}\right)(3x - \frac{2}{3})$

2. Expand and simplify

$(x + 1)(x + 2)(x + 3)$

3. Expand and simplify

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

4. Expand and simplify

$(2 - \sqrt{3})(1 + \sqrt{3})(1 - \sqrt{3})$

5. Find the volume of a cube with side length $x - 4$

6. Expand and simplify

$(x^2 - 2)(x^2 + 2)(x + 1)$

7. Write $(\sqrt{y} + \sqrt{8y})^2$ in the form $a + b\sqrt{2}$.

Given that $(\sqrt{y} + \sqrt{8y})^2 = 54 + b\sqrt{2}$.
Find values for y and b.

8. Simplify $\frac{(x-1)(x+2)}{(x+3)} - \frac{4}{2x+1}$

Section 4: Factorising



Factorising 1



Fully factorise the following:

1. $5x - 30$

2. $9x + 6$

3. $x^2 + 6x$

4. $6y^3 - 12y$

5. $7a^2b + 21ab - 14a$

6. $12x^2 + 12xy + 12y^2$

7. $3t(t - 1) + 7(t - 1)$

8. $2x(x^2 + 3) - 5(x^2 + 3)$



Further Factorising 2



Factorise the following fully:

1. $x^2 + 6x - 7$

2. $y^2 + y - 12$

3. $y^2 - 11y + 28$

4. $t^2 + 7t - 18$

5. $k^2 + 9k + 20$

6. $x^2 + x - 56$

7. $p^2 - 25p$

8. $x^2(3x - 4) + (4 - 3x)$

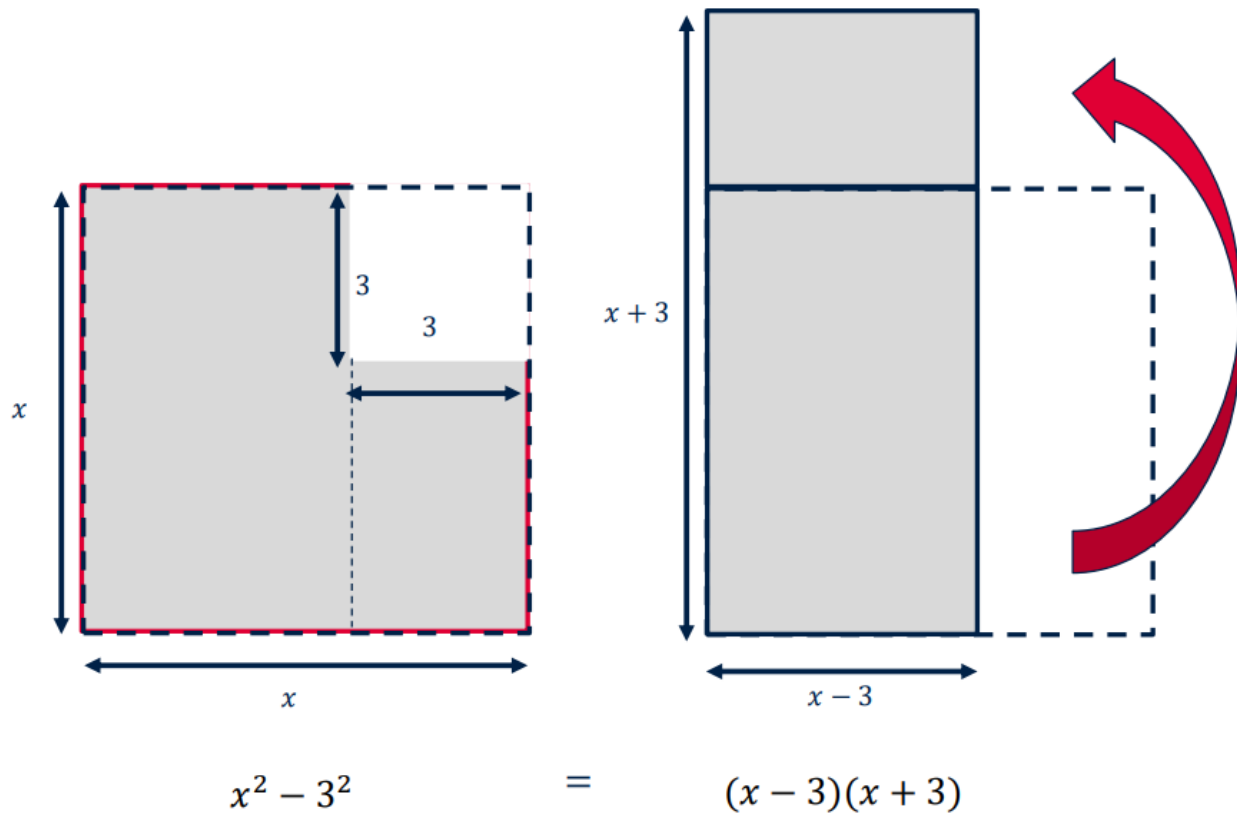


Difference of Two Squares



A special case for factorising is the difference of two squares.

Expressions such as $x^2 - 3^2$, where the coefficient of x is zero.



Try factorising these expressions using the difference of two squares

1. $x^2 - 6^2$
2. $y^2 - 144$
3. $x^2 - y^2$
4. $4t^2 - 81$
5. $x^2 - 5$



Trickier Quadratics



1. $3x^2 - 10x - 8$

2. $2x^2 - 7x + 6$

3. $4y^2 + 20y + 9$

4. $6x^2 - 13x - 8$

5. $20x^2 + x - 12$



Completing the square 1



Write these expressions in the form $(x + a)^2 + b$

1. $x^2 + 4x$

2. $x^2 + 4x + 5$

3. $y^2 - 8y$

4. $y^2 - 8y + 7$

5. $x^2 - 12x + 41$

6. $k^2 + 10k - 2$

7. $y^2 + 3y + 1$

8. $p^2 - 2p + 1$

Section 5: Rearranging



Rearranging 1



1. Solve $3x + 25 = 60$
2. Rearrange $z = w + 3$ to make w the subject
3. Rearrange $5x - 4 = 2y$ to make x the subject
4. Rearrange $y = \frac{t}{6}$ to make t the subject

5. $y = 6p^2 + 2$ rearrange to make p the subject
6. The area of a circle is found using $A = \pi r^2$ Write the equation you would use to find the radius.
7. In a right angled triangle $\sin x = \frac{\text{Opp}}{\text{Hyp}}$ write down the equation for finding the opposite side.
8. To change temperatures in Celsius to Fahrenheit this formula is used.

$$F = \frac{9}{5}C + 32$$

Rearrange to give the formula for converting Celsius to Fahrenheit



Rearranging and Functions



Original function

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

Inverse function

$$f^{-1}(x) = \frac{x-2}{3}$$

Find the inverse of each of these functions.

1. $f(x) = 3x - 5$
2. $f(x) = 4x + 7$
3. $f(x) = \frac{x}{2} + 1$
4. $f(x) = \frac{x+2}{3}$

5. $f(x) = \frac{2}{3}x + 3$
6. $f(x) = 3 - 2x$

Instead of reversing a function machine - try re-arranging the original function to make x the subject



Further Factorising 2



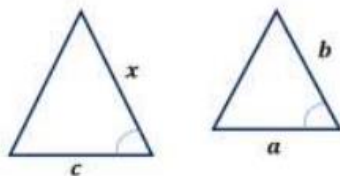
1. Make y the subject of $xy + 6 = 7 - ky$
2. Find an expression for the area of a rectangle with length, $(y - x)$ and width, $(x - 2)$
3. Rewrite your expression in Q2 to have y expressed in terms of A and x
4. Make y the subject of $\frac{4}{y} + 1 = 2x$
5. Displacement can be expressed as
i. $s = ut + \frac{1}{2}at^2$
Express a in terms of s, u and t
6. Make y the subject of $\sqrt{by^2 - x} = D$
7. The area of a trapezium has formula
i. $A = \frac{1}{2}\left(\frac{a+b}{h}\right)$
Express h in terms of A, a and b
8. Make t the subject $b(t + a) = x(t + b)$



Fractions 1



1. Rewrite the formula to make time the subject
$$Speed = \frac{distance}{time}$$
2. Rearrange to make a the subject
$$\frac{x}{y} = \frac{a}{b}$$
3. Make x the subject of $\tan\theta = \frac{y}{x}$
4. These triangles are similar.
Show that $x = \frac{cb}{a}$
5. Make x the subject of $x = \frac{h+k}{a}$
6. Make x the subject of $x + a = \frac{x+b}{c}$
7. Make a the subject of $\frac{1-a}{1+a} = \frac{x}{y}$
8. Make y the subject of $y(\sqrt{3} + \sqrt{2}) = x$
And write in the form $y = x(\sqrt{a} + \sqrt{b})$



Section 6: Solving



Solving Linear 1



Solve the equations

1. $8x - 3 = 5x + 13$
2. $3x + 1 > 10$ and $2x + 7 < 15$
3. $3(x + 6) > 12$
4. $24 - 3x = 9$
5. $14 \geq 8 + 5x$
6. $6 - 2x < 5x + 34$
7. $\frac{2x+3}{7} = \frac{4x-5}{3}$
8. The perimeter of the rectangle is 24cm. Find the value of x .

x cm



$2x + 2$ cm



Linear Simultaneous Equations



There are two main ways to solve simultaneous equations.

Elimination

$$3x + 2y = 9$$

$$5x - 2y = -1$$

Add the two equations together to eliminate y

$$8x = 8$$

$$x = 1$$

Now we have a value for x we can put it into one of the original equations to find y

$$3 \times 1 + 2y = 9$$

$$3 + 2y = 9$$

$$2y = 6$$

$$y = 3$$

Substitution

$$y + 3x = 5$$

$$2y + 7x = 11$$

Rearrange the first equation in terms of y and then substitute into the second equation

$$2(5 - 3x) + 7x = 11$$

$$10 - 6x + 7x = 11$$

$$x = 1$$

Now we have a value for x we can put it into one of the original equations to find y

$$y + 3 \times 1 = 5$$

$$y + 3 = 5$$

$$y = 2$$

Which method is best and when?

Solve the following:

1.

$$2x + y = 7$$

$$2x - y = 1$$

2.

$$3x + 2y = 7$$

$$3x + 5y = 4$$

3.

$$y = 4x + 3$$

$$3x + 2y = 28$$

4.

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

$$6x - 2y = 7$$

Which method
will you use
and why?



Solving with Quadratics 1



Solve the following

1. $x^2 = 16$

5. $(2x - 5)(4x + 3) = 0$

2. $x^2 - 16x = 0$

6. $3x^2 + 14x - 5 = 0$

3. $(x + 1)(2x - 3) = 0$

7. $(x + 3)^2 = 25$

4. $x^2 - 3x + 2 = 0$

8. $\frac{3}{x} + \frac{4}{x-1} = 10$



Using Graphs



Use the graphs to solve

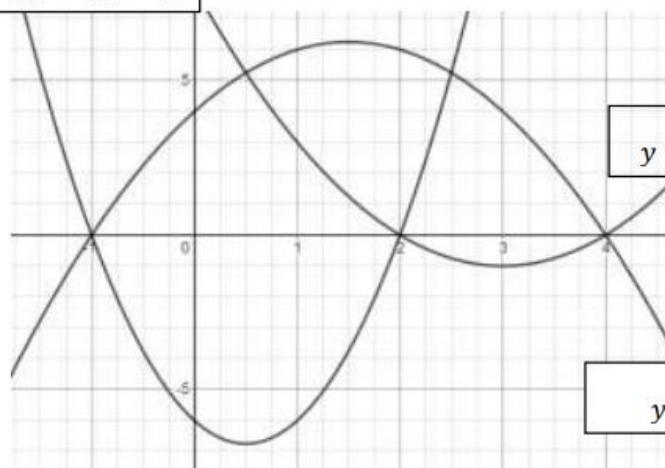
$$4 + 3x - x^2 = 0$$

$$x^2 - 6x + 8 = 0$$

$$3x^2 - 3x - 6 = 0$$

$$4 + 3x - x^2 = 4$$

$$y = 3x^2 - 3x - 6$$



$$y = x^2 - 6x + 8$$

$$y = 4 + 3x - x^2$$



Simultaneously

Solve these pairs of equations

1. $y = x^2 + 6x - 9$ 2. $y = x^2 + 2x + 2$ 3. A rectangle has length $(a + b)$ and width $3a$.

$y = 3x + 1$

$y - 4x = 1$

The area is 60cm^2 and perimeter is 32 cm .

Calculate, algebraically, the values of a and b .

4. In how many places does the line $y = 2x + 2$ intersect the circle $(x + 2)^2 + y^2 = 25$?

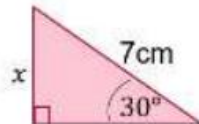
What are the co-ordinates of these intersections?



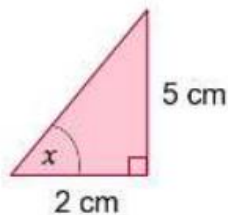
Solving Equations with Trigonometry



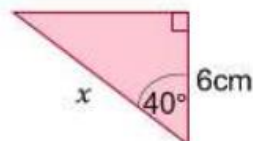
1. Calculate the length of the side marked x in this triangle.



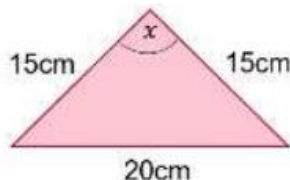
2. Calculate the value of the angle marked x in this triangle.



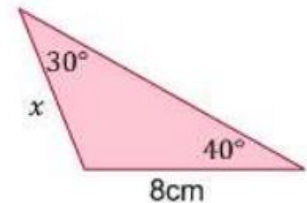
3. Calculate the value of the side marked x in this triangle.



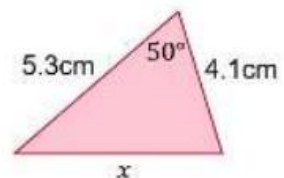
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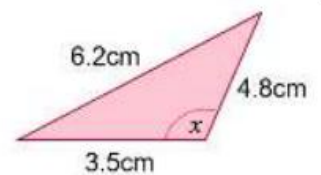
5. Calculate the value of the side marked x in this triangle.



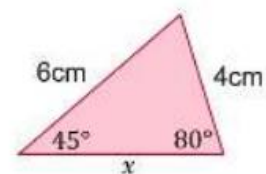
6. Calculate the value of the side marked x in this triangle.



7. Calculate the value of the angle marked x in this triangle.



8. Calculate the value of the side marked x in this triangle.



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