



# St. Alban's Maths

## A Level Transition Work 2022

These resources focus on the key skills that will be needed across the whole spectrum of AS and A Level Maths.

They were created by the AMSP and these are just the questions. They have been taken from full lessons with explanations and solutions.

They can all be found on the AMSP transition website using the link or QR code below, along with further reading.

[www.amspace.org.uk/resource/gcse-alevel-transition-resources](http://www.amspace.org.uk/resource/gcse-alevel-transition-resources)





Make sure that you understand how to do all the questions from these topics before you begin in September. These are essential to your success.

## CONTENTS - The key topics covered in this pack are:

### Simplifying

Simplifying numerical and algebraic expressions is an essential component in maths. Here we look at the key skill of simplifying and how it is applied to fractions, indices and surds in particular.


 [Fractions](#)


 [Indices](#)


 [Surds](#)

### Expanding

This unit looks at expanding – you will look at visual geometrical approaches, multiplication of numeric values, working through to manipulating algebraic expressions involving single, double, triple brackets and beyond! Expanding and simplifying expressions is a key skill in many areas of maths.


 [Expanding](#)


 [Double Brackets](#)


 [More Brackets](#)

### Factorising

In this section we are looking at the topic of factorising. We will look at expressions such as those with common factors or quadratics. Before starting AS or A level Mathematics it is essential that you are confident with factorising expressions and recognising when you can factorise. This skill will become very important when we consider solving and sketching.


 [Factorising](#)


 [Further Factorising](#)


 [Completing the Square](#)

### Rearranging

Being able to rearrange formulae or equations is a fundamental process in algebraic manipulation. From simple conversions to more complicated mathematical formulae, rearranging helps to make calculations easier and plays an important role when studying AS or A level Mathematics. For students studying science as well as maths it is hugely important that you can rearrange scientific formulae with confidence.


 [Rearranging](#)


 [Rearranging and Factorising](#)


 [Rearranging and Fractions](#)

### Solving

The ability to solve equations is fundamental in maths. Whilst the process of solving equations is essential, the interpretation of solutions gained is equally important in real-world applications. Equations can take many forms from the linear and quadratic ones studied at GCSE to more complex ones studied at AS and A level. In this resource we will also look at inequalities which have many applications including maximising profit in business subject to constraints.


 [Linear Equations](#)


 [Quadratic Equations](#)


 [Other Equations](#)

### Sketching

Maybe when studying GCSE Mathematics, and definitely during your A level Mathematics studies, you will hear your teacher ask, "Have you tried drawing a sketch or a diagram?" The use of sketching is a really important tool which can help simplify a written mathematical problem. From geometry in pure maths to mathematical modelling in mechanics, a sketch will help you to make sense of problems which look extremely challenging in written form. In this section we look at uses for sketching and the important role graph drawing packages can play to aid understanding.

 [Linear Sketching](#)

 [Quadratic Sketching](#)

 [Other Sketching](#)



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

5. What is the value of  $\frac{4}{1\frac{3}{4}}$

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

6. How many of these calculations equal 1  
Give reasons

$$\frac{1}{2} + \frac{1}{2} \quad \frac{1}{2} - \frac{1}{2} \quad \frac{1}{2} \times \frac{1}{2} \quad \frac{1}{2} \div \frac{1}{2}$$

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

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

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

4. Calculate  $\frac{5}{6} \times \frac{3}{5}$   
give your answer in simplest form

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

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Simplify the following:

1.  $x^3 \times x^8 =$

5.  $16^{\frac{1}{2}} =$

2.  $\frac{9^8}{9} =$

6. What is the reciprocal of 16?

3.  $(2^3)^5 =$

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

4.  $\frac{4^4 \times 4}{(4^2)^3} =$

8. What is  $\left(\frac{2}{5}\right)^{-1}$  ?



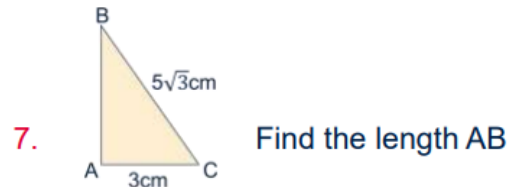
1. Simplify  $\sqrt{a} + 2\sqrt{a} + 5\sqrt{a}$

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  $(4\sqrt{3})^2$



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

8. 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



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

5. Multiply the expressions  $y$  and  $y + 4$   
Which of these expressions show the result?

☐  $5y$

☐  $y(y + 4)$

☐  $y^2 + 4y$

☐  $4y + 4$

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

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

3. Expand and simplify  
 $5(x - 4) + 3(2x + 5)$

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

4. Expand and simplify  
 $4(\sqrt{2} - 3) + 2(\sqrt{2} + 2)$

8. Expand and simplify  $\frac{a}{2} \left(3 + \frac{a}{4}\right) + \frac{a}{3} \left(2 + \frac{a}{2}\right)$



1. Expand and simplify  $(2x + 3)(x - 2)$
2. Expand and simplify  $3x(x + 3) + 4(x + 3)$
3. Expand and simplify  $(x + 6)^2 + (x - 3)^2$
4. Expand and simplify  $(2 - \sqrt{3})^2$
5. Simplify  $\frac{2}{(x+3)} + \frac{x-3}{x}$
6. Expand and simplify  $(x^3 - 7)(x^3 + 7)$
7. Expand and simplify  $(3x + 2)(4x^2 + 2x - 3)$
8. Simplify  $\frac{2x-2}{(x+2)} - \frac{x-2}{3x}$



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



Factorise the following fully:

1.  $x^2 + 5x - 6$

5.  $k^2 - 2k - 24$

2.  $x^2 + 13x - 30$

6.  $p^2 - 10p + 21$

3.  $y^2 - 13y + 30$

7.  $x^2 - 16x$

4.  $t^2 + 2t - 15$

8.  $3x(2x - 1) + 4(1 - 2x)$



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.  $x^2 - 5$



These expressions are slightly different to the previous ones, but can still be factorised.

1.  $2t^2 - 32$

2.  $x^3 - 7x^2 + 12x$

3.  $x^4 - x^2 - 2$

4.  $y^4 - 625$



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

1.  $x^2 + 4x$

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

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

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

3.  $y^2 - 8y$

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

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

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





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



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.  $f(x) = 3 - 2x$





1. The equation of a line is given as  

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

What is the gradient of the line?
2. A rectangle has area  $A$ , length  $y$  and width  $x - 2$ . Write an expression for the length of the rectangle,  $y$ , in terms of  $A$  and  $x$
3. Make  $x$  the subject of:  

$$ax - y = z + bx$$
4. Make  $b$  the subject of:  

$$5(b - p) = 2(b + 3)$$
5. John says the first step to rearranging  $\frac{x-a}{f} = 3g$  is to add  $a$  to  $3g$ . Is he right? Explain your answer.
6. Make  $a$  the subject of  

$$5(a - t) = 3(a + x)$$
7. Make  $x$  the subject of  

$$ay + x = 4x + xb$$
8. Make  $x$  the subject of  

$$2\pi\sqrt{x+t} = 4$$



1. Make  $x$  the subject of  

$$bc = \frac{x}{a}$$
2. Make  $e$  the subject of  

$$x = \frac{y}{e^2}$$
3. Write  $a$  in terms of  $x, y, z$  and  $b$   

$$\frac{b-xa}{z} = y$$
4. Make  $v$  the subject of  

$$C = \frac{v^2 - ta}{x}$$
5. Rearrange to make  $x$  the subject of  

$$\frac{2}{x} + 5 = 6y$$
6. Make  $x$  the subject of  

$$4F = F + \frac{a}{y+x}$$
7. Make  $y$  the subject of  

$$\sqrt{\frac{m(y+a)}{y}} = g$$
8. A cylinder has a radius of  $3cm$  and height,  $h$ . The total surface area =  $30x \text{ cm}^2$ .  
  

Find an expression for the surface area and write  $h$  in terms of  $x$  and  $\pi$



Solve the following:

1.  $8x - 3 = 5x + 13$

5.  $14 \geq 8 + 5x$

2.  $3x + 1 > 10$  and  $2x + 7 < 15$

6.  $6 - 2x < 5x + 34$

3.  $3(x + 6) > 12$

7.  $\frac{2x + 3}{7} = \frac{4x - 5}{3}$

4.  $24 - 3x = 9$

8. The perimeter of the rectangle is 24cm. Find the value of  $x$

$x$  cm



$2x + 2$  cm

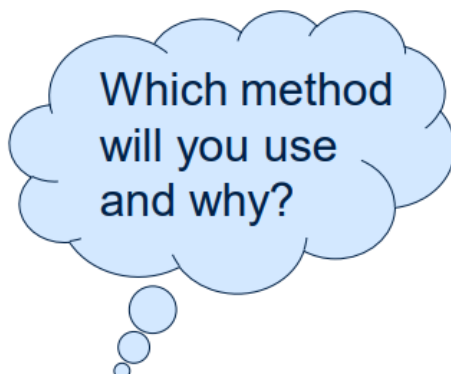


Solve the following:

1.  $2x + y = 7$   
 $2x - y = 1$

3.  $y = 4x + 3$   
 $3x + 2y = 28$

2.  $3x + 2y = 7$   
 $3x + 5y = 4$



4.  $4x + 3y = -4$   
 $6x - 2y = 7$

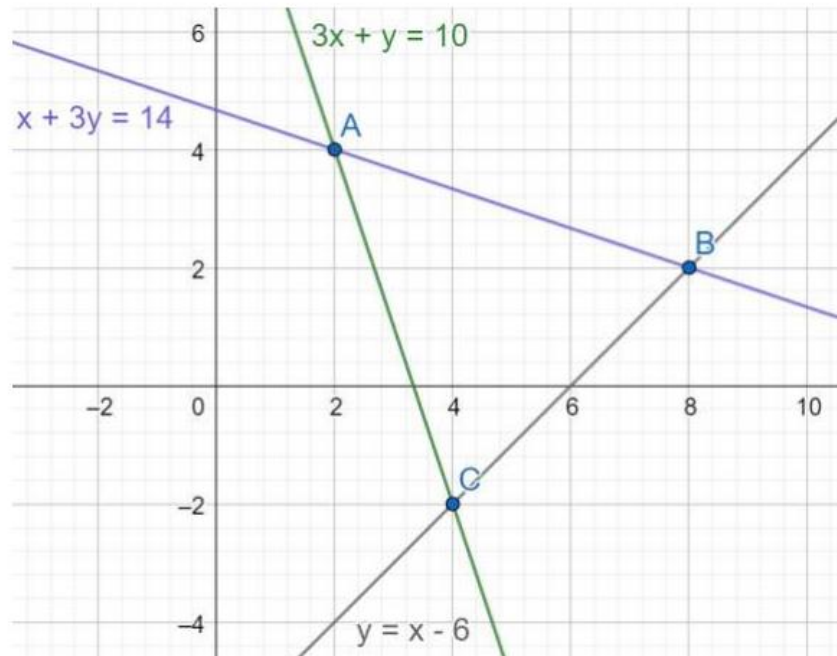


Use the graphs to solve these pairs of equations

1.  $3x + y = 10$   
 $x + 3y = 14$

2.  $y = x - 6$   
 $3x + y = 10$

3.  $x + 3y = 14$   
 $y = x - 6$



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



Solve the following

1.  $x^2 - 4x - 12 = 0$

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

2.  $x^2 - x = 6$

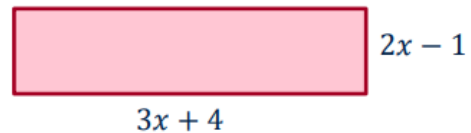
6.  $x^2 - 4x - 1 = 0$

3.  $2x^2 - 11x + 12 = 0$

7.  $\frac{8}{x+2} - \frac{14}{x-3} = 9$

4.  $6x^2 + x - 12 = 0$

8. The area of this rectangle is  $30m^2$



- a) Show that  $6x^2 + 5x - 34 = 0$   
b) Find any possible values for  $x$



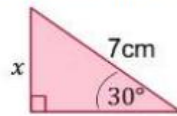
Solve these pairs of equations

1.  $y = x^2 + 6x - 9$   
 $y = 3x + 1$

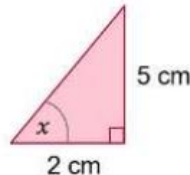
2.  $y = x^2 + 2x + 2$   
 $y - 4x = 1$



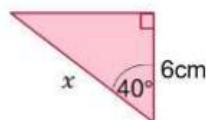
1. Calculate the length of the side marked  $x$  in this triangle.



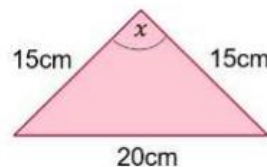
2. Calculate the value of the angle marked  $x$  in this triangle.



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

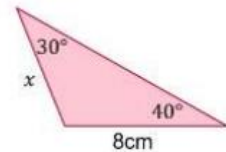


4. Calculate the value of the angle marked  $x$  in this triangle.



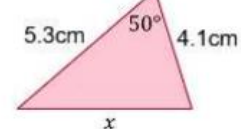
5. Calculate the value of the side marked  $x$  in this triangle

Sine rule

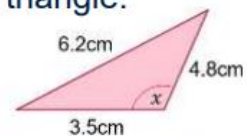


6. Calculate the value of the side marked  $x$  in this triangle.

Cosine rule

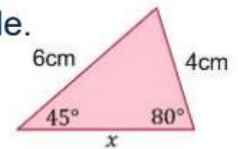


7. Calculate the value of the angle marked  $x$  in this triangle.



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

Sine rule



Solve the following:

1.  $3^x = 243$

5.  $3\sqrt{x} + 12 = 7\sqrt{x}$

2.  $2^{2x+3} = 128$

Hint: write 128 in terms of powers of 2

6.  $\sin x = \frac{1}{2} \quad 0 \leq x \leq 360$

3.  $\sqrt{x+3} = 7$

7.  $\cos x = 0.866 \quad 0 \leq x \leq 360$

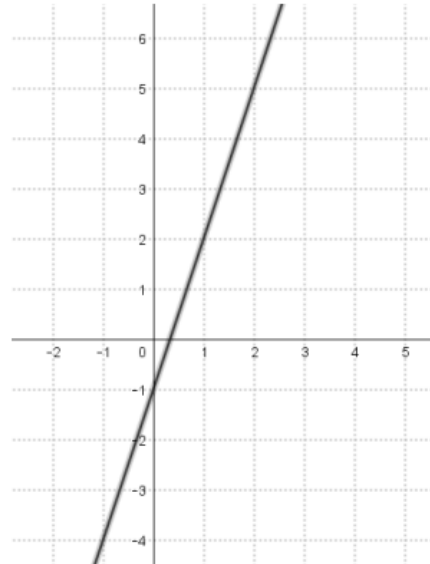
4.  $2\sqrt{x} = \sqrt{12}$

8.  $\frac{8}{3x+7} = 2$



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?



- Sketch and shade the following inequalities.

1.  $y \leq 6$

2.  $x < 6$

3.  $x + 2y \geq 8$

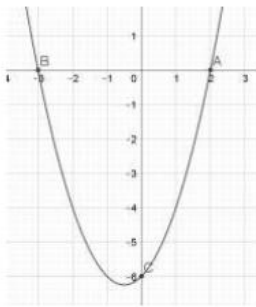
4.  $3x + 2y \geq 12$

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

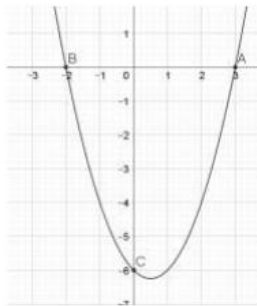




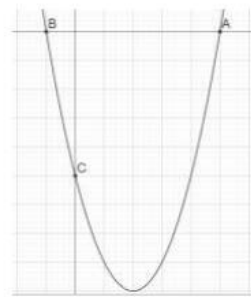
Find the coordinates of A, B and C etc.. on each graph



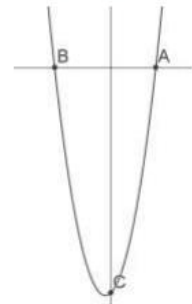
$$y = (x + 3)(x - 2)$$



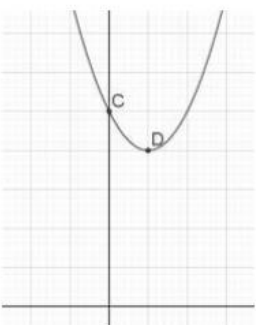
$$y = (x - 3)(x + 2)$$



$$y = (x - 5)(x + 1)$$



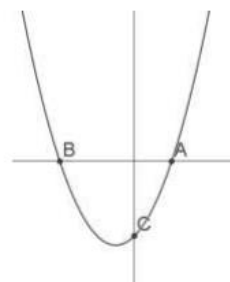
$$y = (x - 4)(x + 5)$$



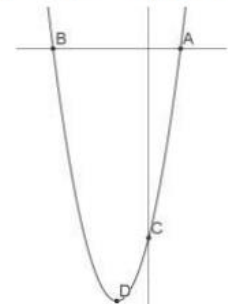
$$y = (x - 1)^2 + 4$$



$$y = (x + 3)^2 + 7$$



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



$$y = 2x^2 + 4x - 6$$

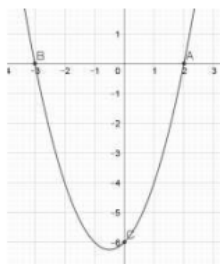
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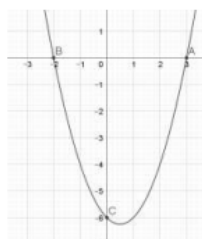
1. What are the  $x$  intercepts of

$$y = (2x + 3)(x + 4)$$

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



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

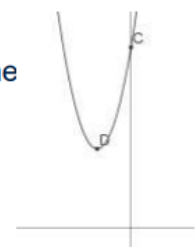


4. What are the  $x$  intercepts of the graph of  $y = 6x^2 + x - 2$

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  $x$  and  $y$  intercepts

7. What are the co-ordinates 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

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Use a sketch to help you solve the following inequalities

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

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

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

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



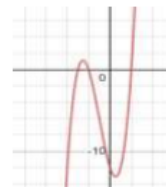
1. What is the mathematical name for the graph of  $y = \frac{1}{x}$ ?

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  
 $y = (x - 3)(x + 2)(x + 5)$