Interactive I.T. Student Activity Sheets Junior Certificate Strand 5

- **Student Activities written to match the I.T. interactive modules on the Project Maths Junior Certificate Student's CD Strand 5**
- **Interactive Activity Sheets included to enhance students' understanding of mathematical concepts**
- **Simple and clear guidelines are provided to facilitate learning**
- **Interesting questions are provided to lead students to explore, construct and consolidate their learning**

Preface

The NCCA have pointed out particular Key Skills in their Draft Syllabus. "While particular emphasis is placed in mathematics on the development and use of information processing, logical thinking and problem-solving skills, the new approach being adopted in the teaching and learning of mathematics will also give prominence to students being able to develop their skills in communicating and working with others. By adopting a variety of approaches and strategies for solving problems in mathematics, students will develop their self-confidence and personal effectiveness." To help our students to adapt to and take advantage of this new spirit of the syllabus, we have produced Interactive I.T. Student Activity Sheets which incorporate an innovative and diversified learning environment for mathematics.

As we all know, the advancement in technology has changed the way we can learn mathematics. Therefore we have developed a number of interactive modules on our student's CD to match this new development. With the help of these interactive modules, students can not only enhance their understanding in mathematics, but they can also enjoy learning it.

In order to help our students use the I.T. tools more effectively, ***Interactive I.T. Student Activity Sheets Junior Certificate Strand 5*** are produced in this booklet. A student activity sheet is designed for the majority of the interactive modules on the CD. All student activity sheets provide simple and clear guidelines including:

1. Reference to the related topics in ***Project Maths Student's Junior Certificate Strand 5 section***
2. Purpose of the I.T. tools
3. Instructions for using the I.T. tools.

These Student Activity Sheets, which include many interesting questions, will lead students to explore, construct, and consolidate their knowledge of mathematics on their own with ease. We believe that with the help of these activities, students' knowledge and understanding of mathematics will grow.

Table of Contents

Instructions for use

This booklet contains student activities to accompany the majority of the interactive files on the Junior Certificate Strand 5 section of the student disk. The specific section of the course that the activity relates to is specified in the name of the activity. At the top of each student activity the students are told what interactive file on the student disk is to accompany the student activity.

Technical Problems

The student disk has a link situated on the left hand side of its front page called "Troubleshooting" this section gives instructions, if any of the following problems are encountered:

- Problems opening Office 2007 documents
- You do not have Java on your machine
- You do not have a PDF reader on your machine.

Student Activity 1a

Project Maths Tionscadal Mata Development Team

Tables for each of the functions below are drawn on the next page of this document for $x \in \{-3,-2,-1,0,1,2,3\}$. Fill out all the tables first so that you can decide on a scale which will suit all the functions when plotting a graph. Plot all the graphs **using the same axes and scales** using the grid given on the next page. Verify the shape of each graph by calculating y values of points, in between those plotted, and comparing the answers with the y values of the same points given by y our graph.

Polynomial in the form $f(x)=ax^2$ $a \in N$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts (algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x)=0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$y=x^2$												
$y=2x^2$												
$y=3x^2$												
$y=\frac{1}{2}x^2$												

1. What is the effect of the coefficient "a" on the graph of the function $f(x)=ax^2$?

2. Which of the above functions has the greatest rate of change of y with respect to x? How can you check this?

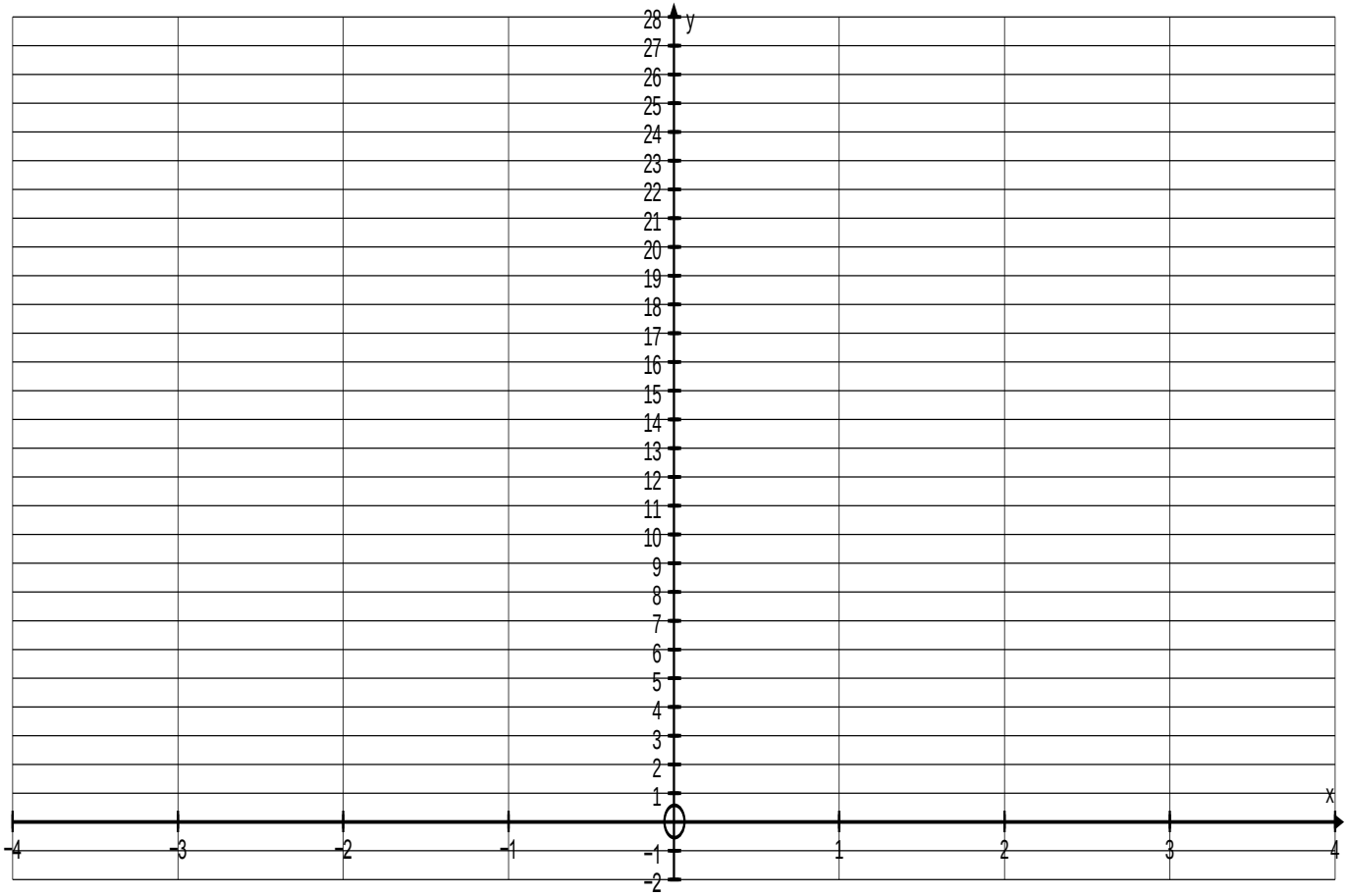
3. Which of the above functions has the smallest rate of change of y with respect to x? How can you check this?

4. What point on the graph does the axis of symmetry pass through?

Student Activity 1a

Project Maths Tionscadal Mata Development Team

Draw all graphs in pencil first and then outline the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves. Label all graphs clearly.



x	$y = x^2$	(x, y)

x	$y = 2x^2$	(x, y)

x	$y = 3x^2$	(x, y)

x	$y = 0.5x^2$	(x, y)

Student Activity 1b

Project Maths Tionscadal Mata Development Team

Tables for each of the functions below are drawn on the next page of this document for $x \in \{-3,-2,-1,0,1,2,3\}$.

Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.
Plot all the graphs **using the same axes and scales** using the grid given on the next page.
Verify the shape of each graph by calculating y values of points, in between those plotted, and comparing the answers with the y values of the same points given by your graph.

Polynomial in the form $f(x)=ax^2$ $a \in Z$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts (algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x)=0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$y=x^2$												
$y=-x^2$												
$y=2x^2$												
$y=-2x^2$												

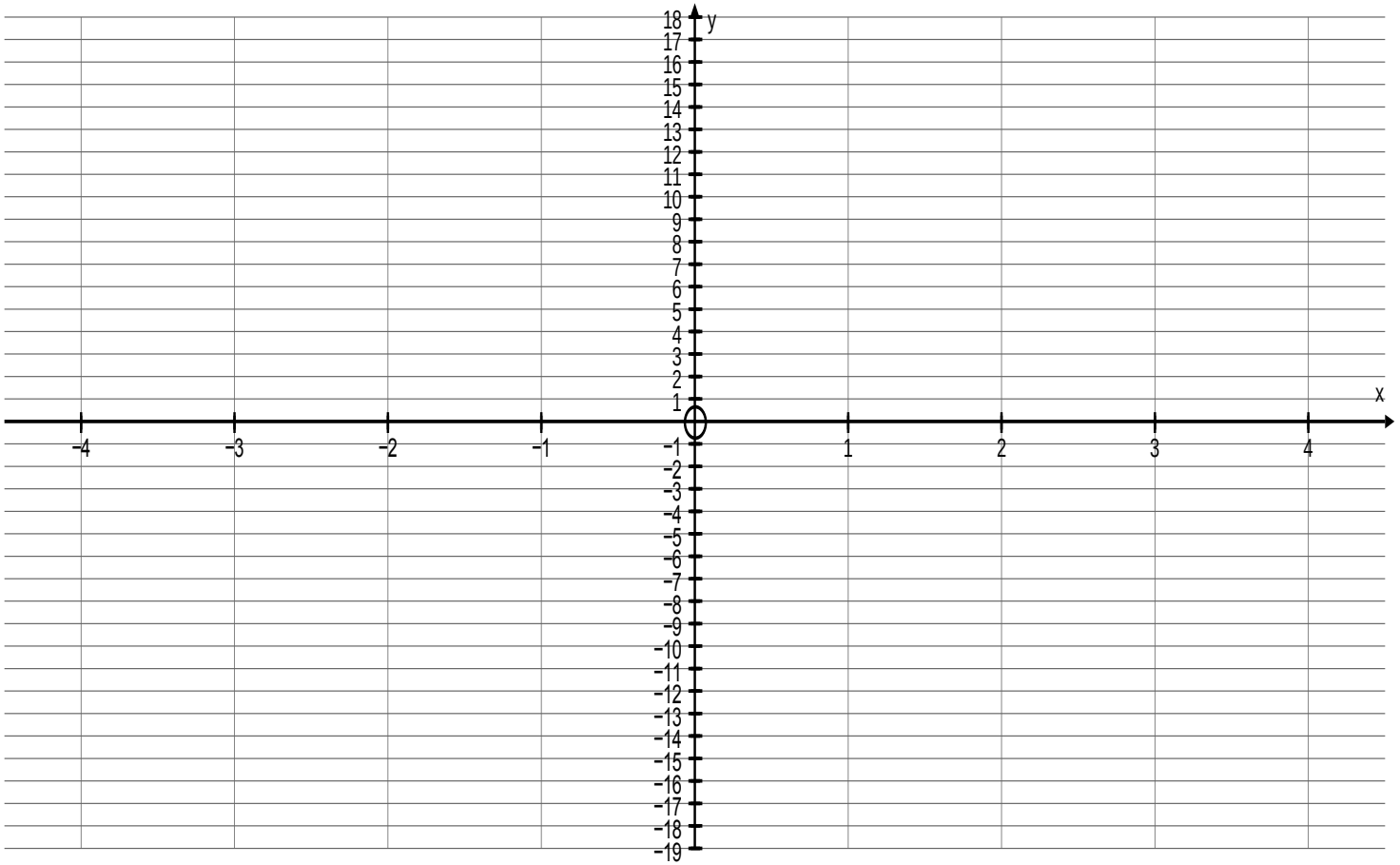
1. What is the effect of the sign of the coefficient "a" on the graph of function $f(x)=ax^2$? Explain

Student Activity 1b

Project Maths Tionscadal Mata Development Team

Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.



x	$y = x^2$	(x, y)

x	$y = -x^2$	(x, y)

x	$y = 2x^2$	(x, y)

x	$y = -2x^2$	(x, y)

Student Activity 1c

Development Team

Tables for each of the functions below are drawn on the next page of this document for $x \in \{-3,-2,-1,0,1,2,3\}$.

Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.
Plot all the graphs **using the same axes and scales** using the grid given on the next page.

Verify the shape of each graph by calculating y values of points, between those plotted, and comparing the answers with the y values of the same points given by your graph.

Polynomial in the form $f(x)=x^2\pm c$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts (algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x)=0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$y=x^2$												
$y=x^2+8$												
$y=x^2-8$												
$y=x^2+2$												

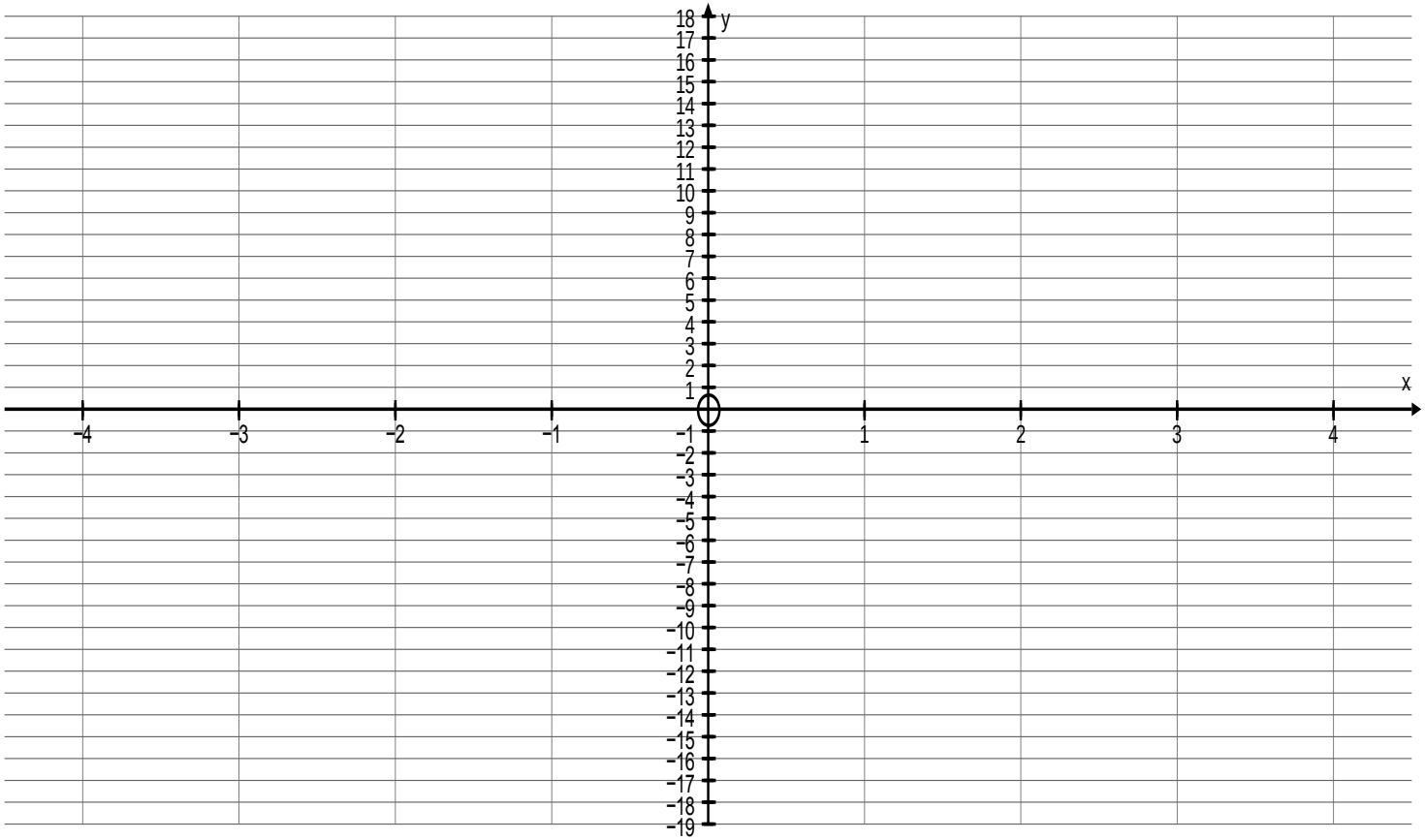
1. What is the effect of the constant c on the graph of the function $f(x)=x^2\pm c$? Explain.

Student Activity 1c

Project Maths Tionscadal Mata Development Team

Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.



x	$y = x^2$	(x, y)

x	$y = x^2 + 8$	(x, y)

x	$y = x^2 - 8$	(x, y)

x	$y = x^2 + 2$	(x, y)

Student Activity 1d

Tables for each of the functions below are drawn on the next page of this document for $x \in \{-3,-2,-1,0,1,2,3\}$.

Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.
Plot all the graphs **using the same axes and scales** on the grid given below. Verify the shape of each graph by calculating y values of points, between those plotted, and comparing the answers with the y values of the same points given by your graph.

Polynomial in the form $f(x)=ax^2 \pm c$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts (algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x) =0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$y=x^2$												
$y=3x^2$												
$y=3x^2-4$												
Your own example												

1. What is the effect of the constant a on the graph of the function $f(x)=ax^2 \pm c$? Explain

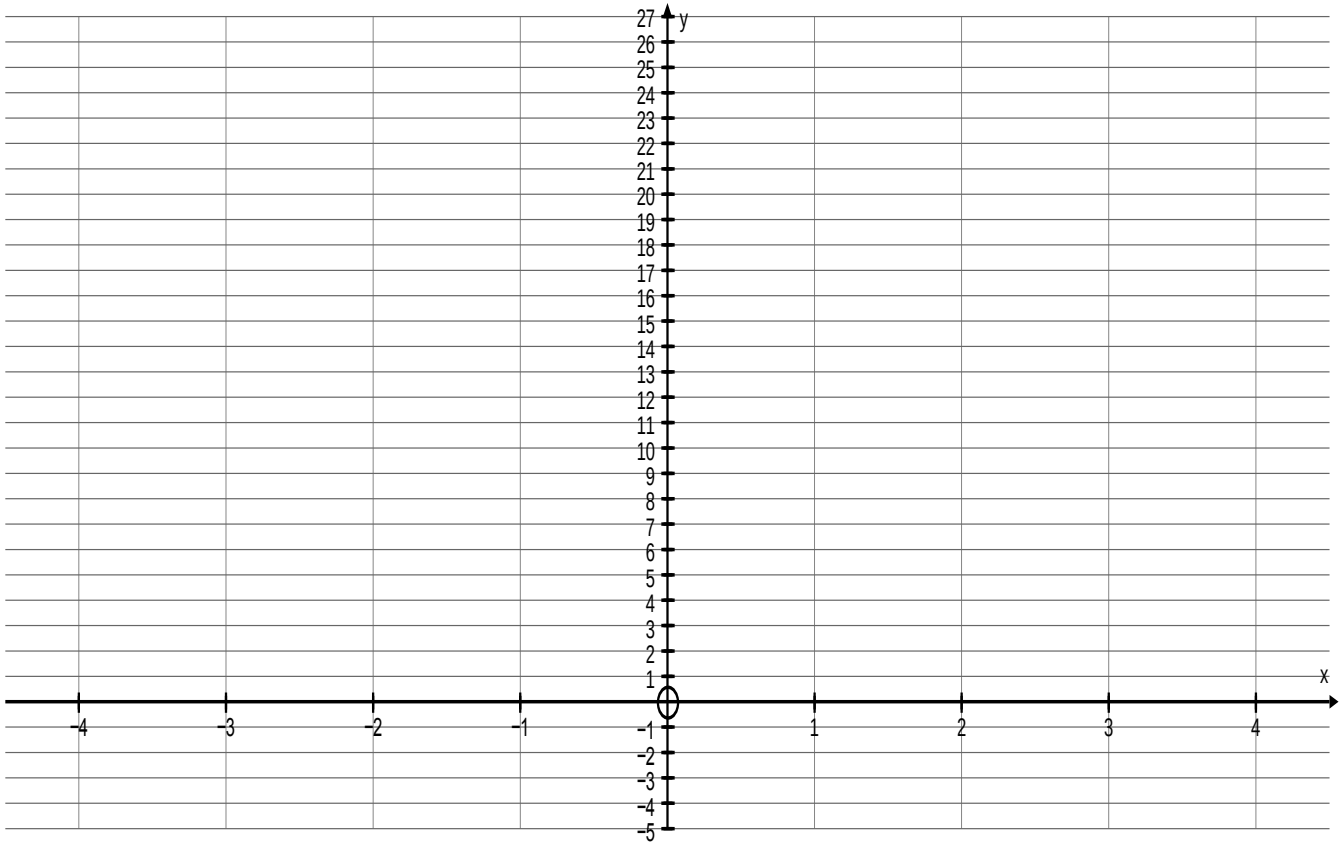
2. What is the effect of the constant c on the graph of the function $f(x)=ax^2 \pm c$? Explain

Student Activity 1d

Project Maths Tionscadal Mata Development Team

Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.



x	$y = x^2$	(x, y)
x		

x	$y = 3x^2$	(x, y)

x	$y = 3x^2 - 4$	(x, y)

x	$y =$	(x, y)

Student Activity 2a

Development Team

Tables for each of the functions below are drawn on the next page of this document. Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.
Plot all the graphs **using the same axes and scales** using the grid given on the next page. Verify the shape of each graph by calculating y values of points, between those plotted, and comparing the answers with the y values of the same points given by your graph.

Polynomial in the form $f(x)=(x+h)^2$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts(algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x)=0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$f(x)=x^2$												
$y=(x+1)^2$												
$y=(x-1)^2$												

1. If h is positive how does the graph of $y=(x+h)^2$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+h)^2$?

2. If h is negative how does the graph of $y=(x+h)^2$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+h)^2$?

3. Solve $x^2=(x+1)^2$ using tables, graphs and algebraically.

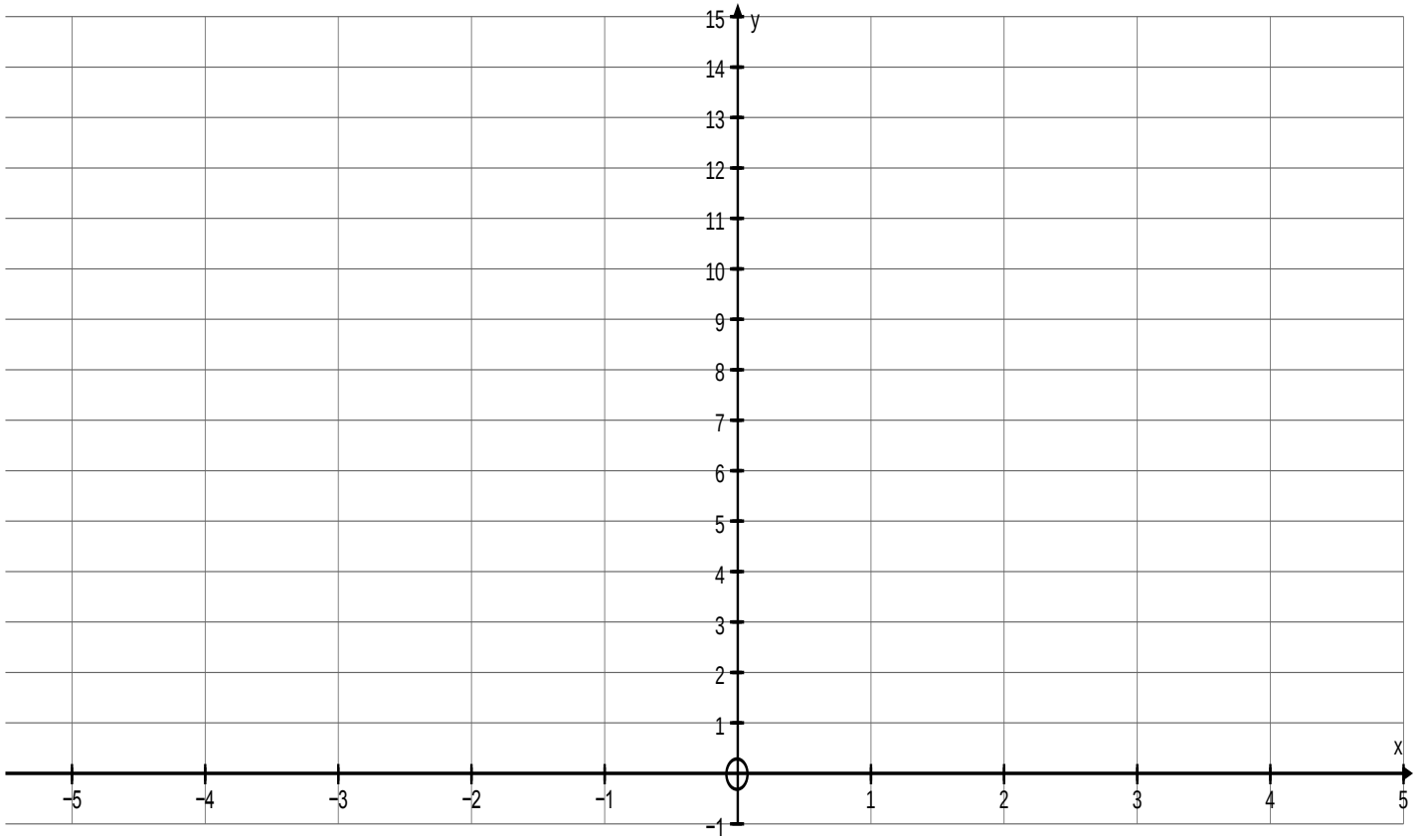
4. Solve $x^2=(x-1)^2$ using tables, graphs and algebraically.

Student Activity 2a

Project Maths Tionscadal Mata Development Team

Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.



1. Can you write $y = (x+1)^2$ in a different way? Verify using the graph.

2. Can you write $y = (x-1)^2$ in a different way? Verify using the graph.

Tables for each of the functions below are drawn on the next page of this document.
Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.

x	$y = x^2$	(x, y)
-3		
-2		
-1		
0		
1		
2		
3		

x	$y = (x+1)^2$	(x, y)
-4		
-3		
-2		
-1		
0		
1		
2		

x	$y = (x-1)^2$	(x, y)
-2		
-1		
0		
1		
2		
3		
4		

x		(x, y)

Student Activity 2a

Plot all the graphs **using the same axes and scales** using the grid given on the next page. Verify the shape of each graph by calculating y values of points, between those plotted, and comparing the answers with the y values of the same points given by your graph.

Polynomial in the form $f(x)=(x+h)^2$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts(algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x)=0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$y=x^2$												
$y=(x+2)^2$												
$y=(x-2)^2$												

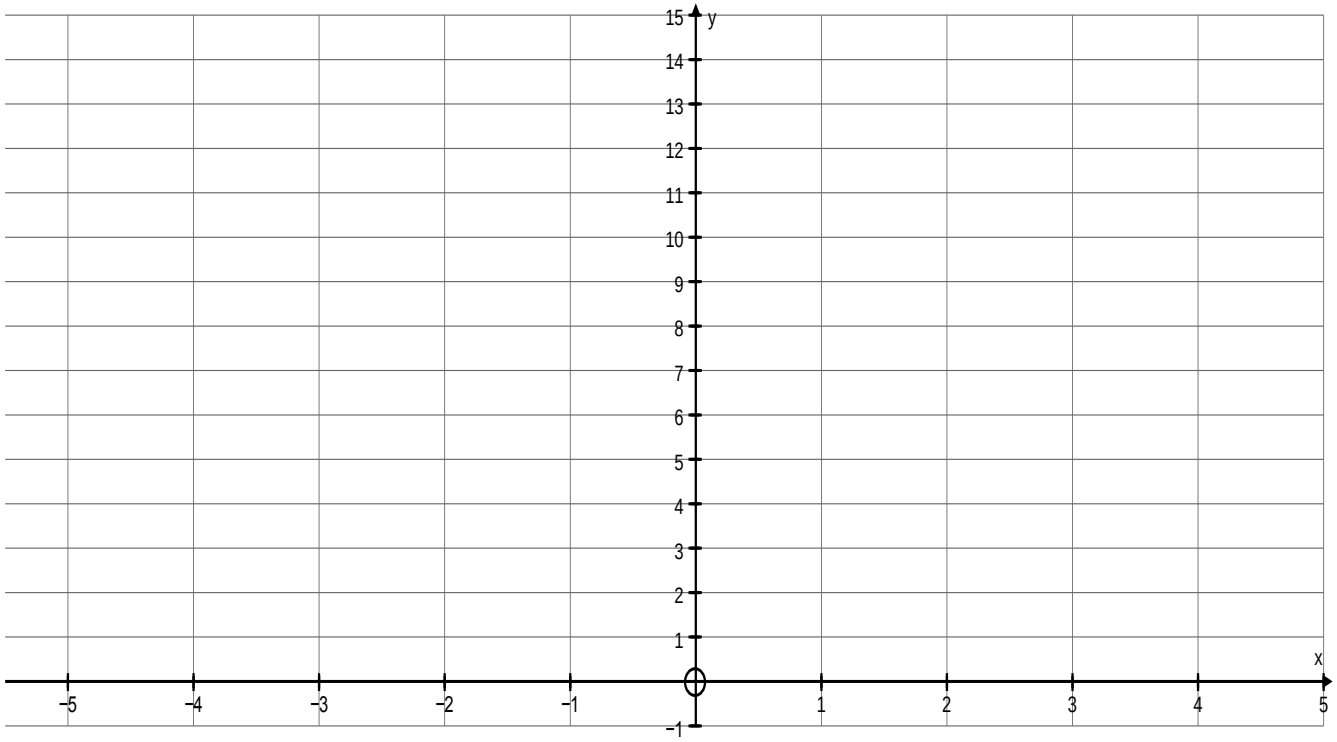
1. If h is positive how does the graph of $y=(x+h)^2$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+h)^2$?

2. If h is negative how does the graph of $y=(x+h)^2$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+h)^2$?

3. Solve $x^2=(x+2)^2$ using tables, graphs and algebraically.

4. Solve $x^2=(x-2)^2$ using tables, graphs and algebraically.

Student Activity 2a



Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.

1. Can you write $y = (x+2)^2$ in a different way? Verify using the graph.

2. Can you write $y = (x-2)^2$ in a different way? Verify using the graph.

Tables for each of the functions below are drawn on the next page of this document. Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.
Plot all the graphs **using the same axes and scales** using the grid given on the next page. Verify the shape of each graph by calculating y values of points, between those plotted, and comparing the answers with the y values of the same points given by your graph.

	$y = x^2$	(x, y)
-3		
-2		
-1		
0		
1		
2		
3		

x	$y = (x+2)^2$	(x, y)
-5		
-4		
-3		
-2		
-1		
0		
1		

x	$y = (x-2)^2$	(x, y)
-1		
0		
1		
2		
3		
4		
5		

Student Activity 2a

Project Maths Tionscadal Mata Development Team

Polynomial in the form $f(x)=(x+h)^2$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts(algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x)=0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0?$	For what x values is f(x) negative i.e. $f(x)<0?$	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$f(x)=x^2$												
$y=(x+3)^2$												
$y=(x-3)^2$												

1. If h is positive how does the graph of $y=(x+h)^2$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+h)^2$?

2. If h is negative how does the graph of $y=(x+h)^2$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+h)^2$?

3. Solve $x^2=(x+3)^2$ using tables, graphs and algebraically.

4. Solve $x^2=(x-3)^2$ using tables, graphs and algebraically.

Student Activity 2a

Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.

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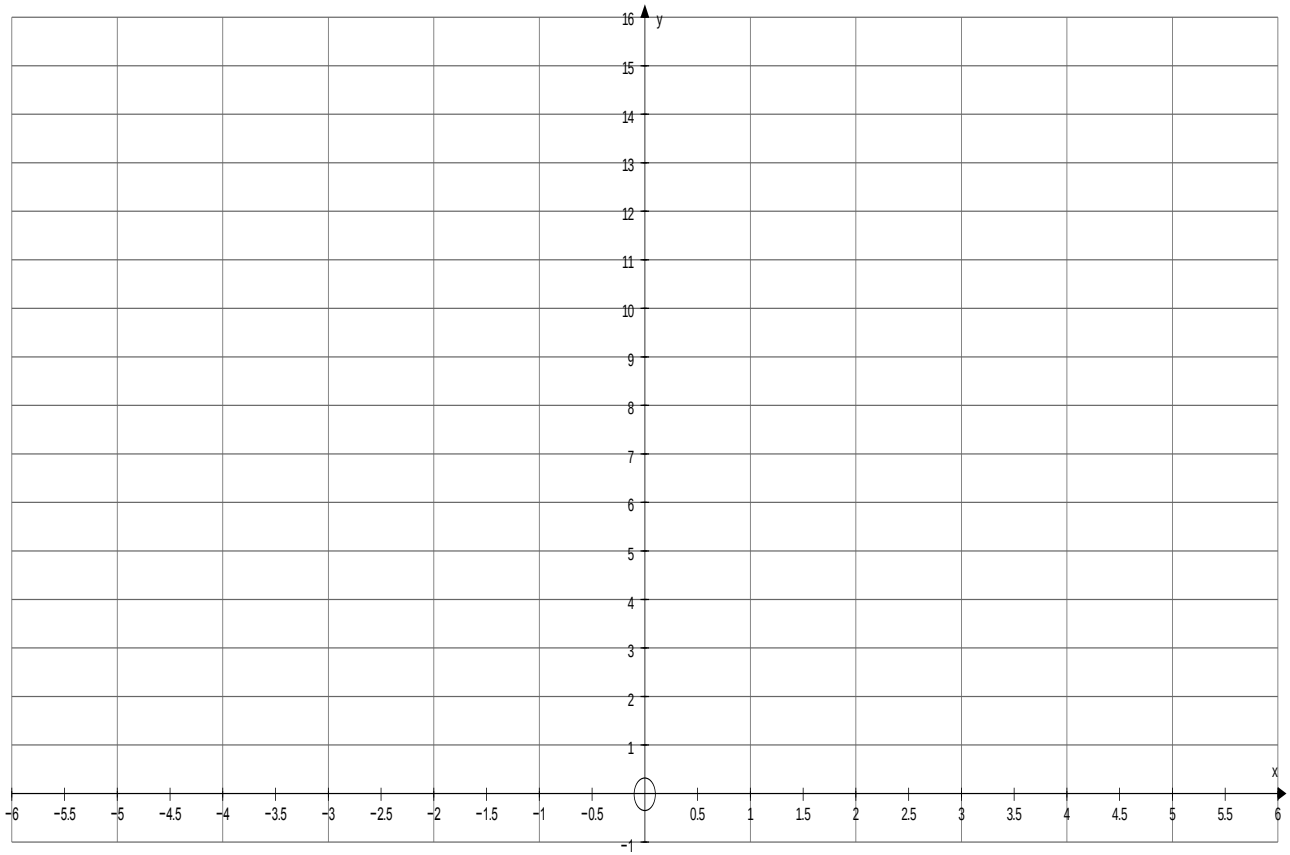


Can you write $y = (x+3)^2$ in a different way? Verify using the graph.

Can you write $y = (x-3)^2$ in a different way? Verify using the graph.

x	$y = x^2$	(x, y)
-3		
-2		
-1		
0		
1		
2		
3		
x	$y = (x+3)^2$	(x, y)
-6		
-5		
-4		
-3		
-2		
-1		
0		
x	$y = (x-3)^2$	(x, y)
0		
1		
2		
3		
4		
5		
6		
x		(x, y)

Student Activity 2b

Project Maths Tionscadal Mata Development Team

Tables for each of the functions below are drawn on the next page of this document for $x \in \{-3,-2,-1,0,1,2,3\}$.

Fill out the tables for each function first so that you can decide on a scale which will suit all the functions when plotting a graph.
Plot all the graphs **using the same axes and scales** using the grid given on the next page. Verify the shape of each graph by calculating y values of points, between those plotted, and comparing the answers with the y values of the same points given by your graph.

Polynomial in the form $f(x)=a(x+h)^2+k$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts (algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x) =0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive i.e. $f(x)>0$?	For what x values is f(x) negative i.e. $f(x)<0$?	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$f(x)=x^2$												
$y=(x+2)^2$												
$y=(x+2)^2-3$												
$y=2(x+2)^2$												
$y=2(x+2)^2-3$												

1. How does the graph of $y=(x+2)^2+3$ compare to the graph of $y=x^2$? What transformation of the plane will transform $y=x^2$ onto $y=(x+2)^2+3$?

2. How does the graph of $y=2(x+2)^2-3$ compare to $y=x^2$?

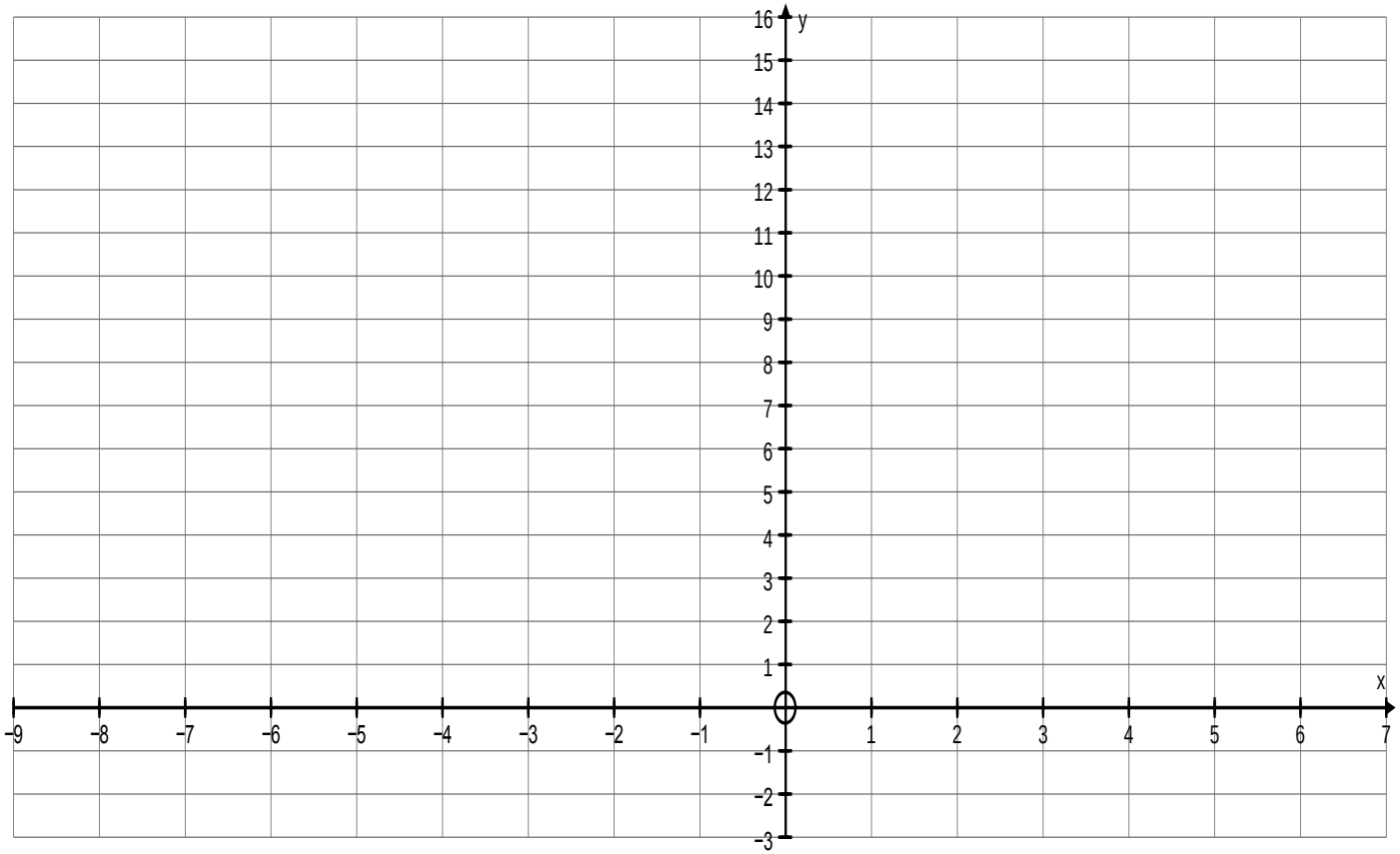
3. Compare and contrast the graphs of $y=(x+2)^2-3$ and $y=2(x+2)^2-3$.

Student Activity 2b

Project Maths Tionscadal Mata Development Team

Draw the graph of $y = x^2$ using a black marker and use different coloured markers to draw the other curves.

Label all the graphs clearly.



x	$f(x) = x^2$	(x, y)

x	$y = (x+2)^2$	(x, y)

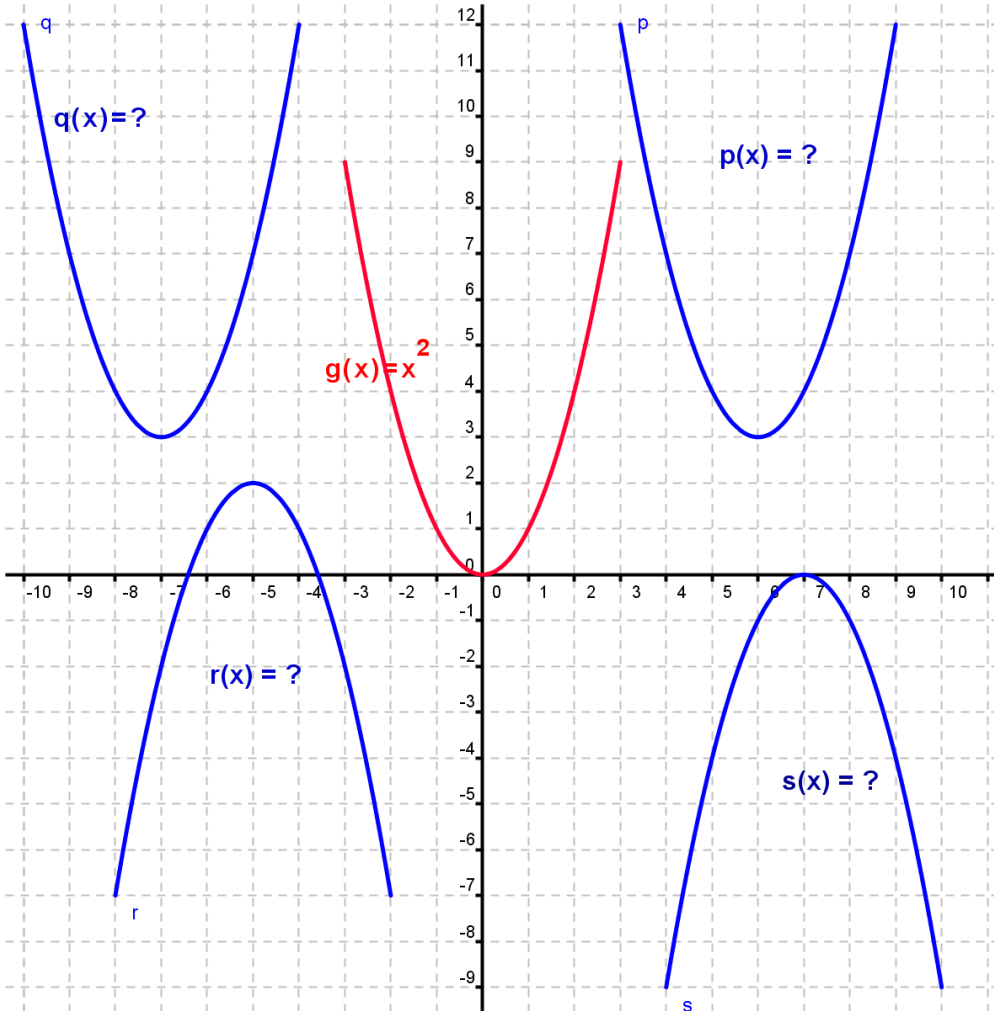
x	$y = (x+2)^2 - 3$	(x, y)

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

Student Activity 2b

On the axes below g is the graph of the function $g(x)=x^2$

Write the equations for the graphs the functions $p, q, r,$ and s in the form $y=(x+h)^2+k$



$p(x)=$
$s(x)=$
$r(x)=$
$q(x)=$

Student Activity 3a

Development Team

Tables for each of the functions below are drawn on the next page of this document for $x \in \{-2,-1,0,1,2,3,4,5,6\}$.

What do you notice about all the tables?

Using the same axes and scales plot the points for each function and join up the points to form an appropriate curve.

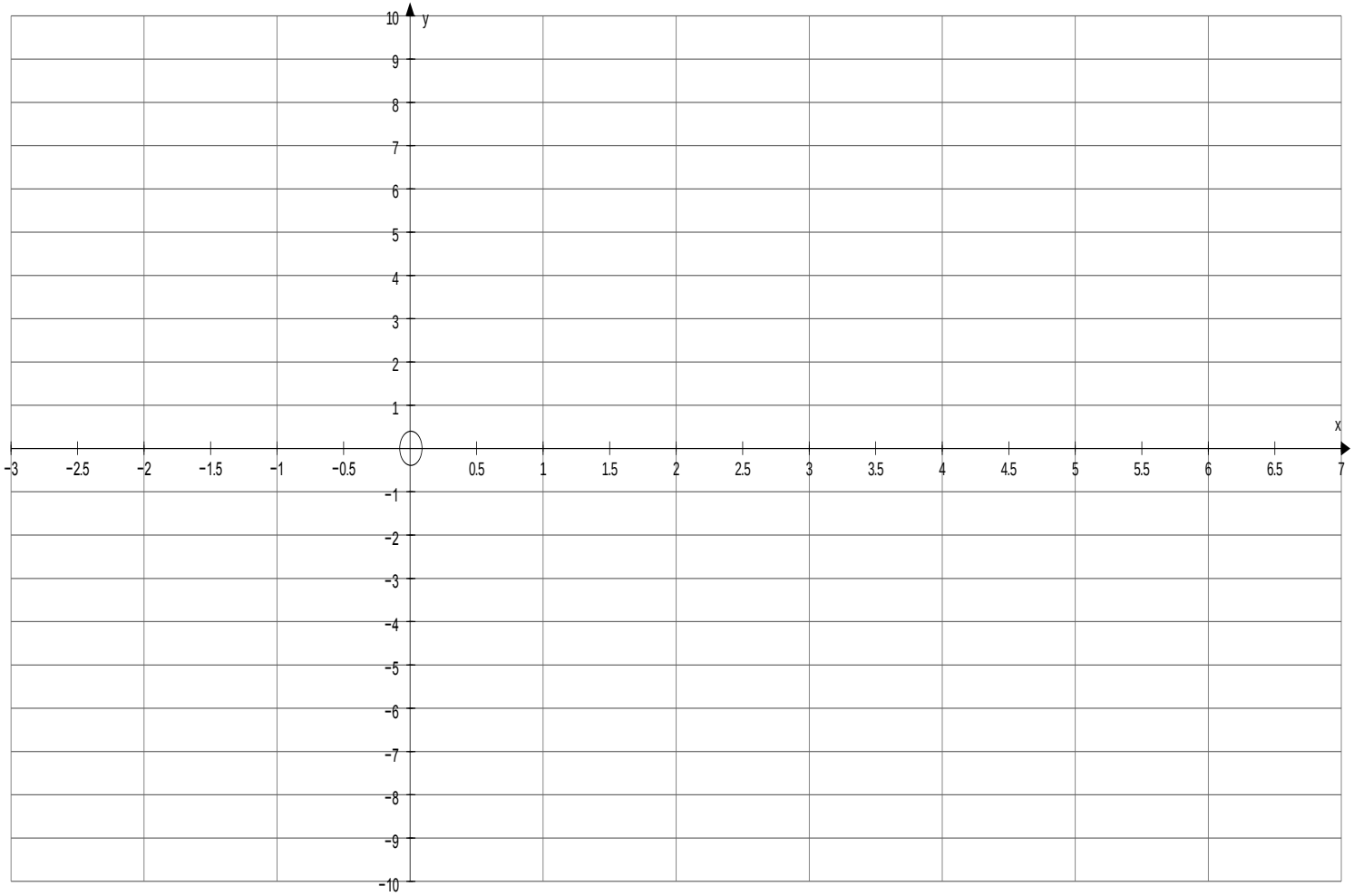
Polynomial in the form $f(x)=ax^2+bx+c$ $f(x)=(x+r)(x+s)$ $f(x)=(x+h)^2+k$	State the shape of the graph and whether it opens upwards or downwards	x – intercepts (algebraic method and using the graph)	y – intercept (algebraic method and using the graph)	Maximum/ minimum point as an ordered pair and labelled as max or min	Real root(s) of f(x) =0	Equation of the axis of symmetry	f (2.7)	Solve f(x) = 8	For what x values is f(x) positive? $f(x)>0$	For what x values is f(x) negative? $f(x)<0$	For what x values is f(x) increasing?	For what x values is f(x) decreasing?
$y=x^2-4x-5$												
$y=(x-5)(x+1)$												
$y=(x-2)^2-9$												

1. What do you notice about all of the graphs and all of the three functions you have plotted in this activity?
2. What items of information about the graph can you read from the equation $y=x^2-4x-5$ before you plot its graph?
3. What extra items of information can you tell about the graph in this factored form $y=(x-5)(x+1)$?
4. What are the roots of $y=(x-5)(x+1)$?
5. What are the roots of $y=(x+r)(x+s)$
6. What extra item of information can you tell about the graph when f(x) is in the form $y=(x-2)^2-9$?
7. How does knowing the x- intercepts (roots) help us to find the axis of symmetry?

Student Activity 3a

Project Maths Tionscadal Mata Development Team

Plot the points and draw the graph for each of the functions in the tables on this page.



x	$y = x^2 - 4x - 5$	(x, y)
x		

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

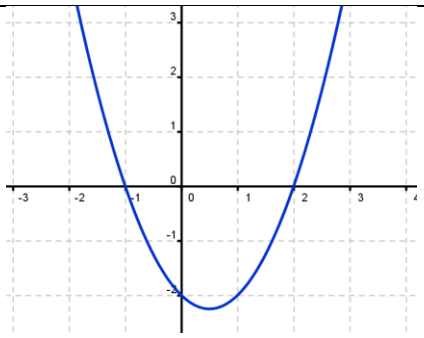
x	$y = (x-2)^2 - 9$	(x, y)

Student Activity 3a

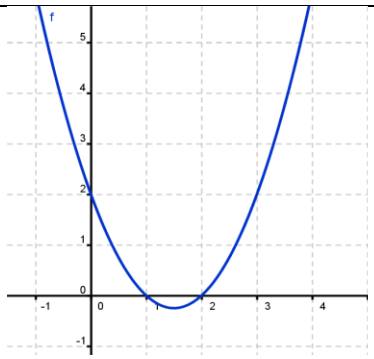
Write the equation for each graph below in factored form i.e. $y=(x+r)(x+s)$ and also in the general form $y=ax^2+bx+c$.

1. How are the roots linked to the factored form? Explain your answer.
2. How is the y - intercept linked to the general form? Explain your answer.

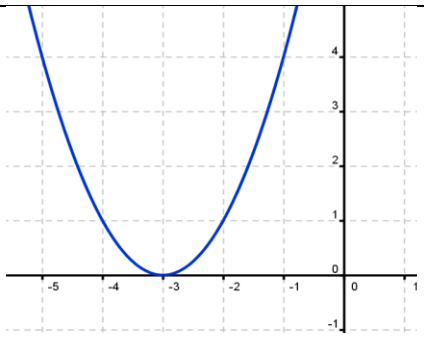
1.



2.



3.



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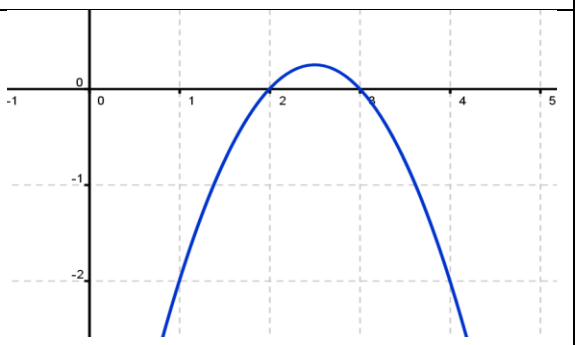

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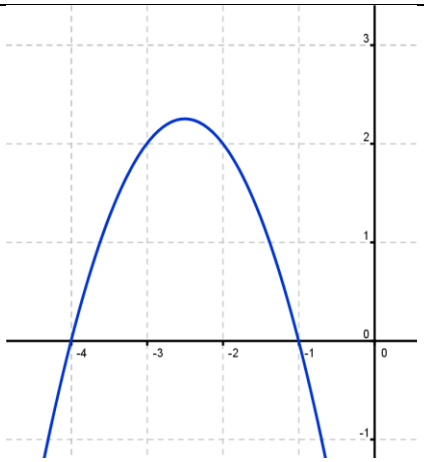
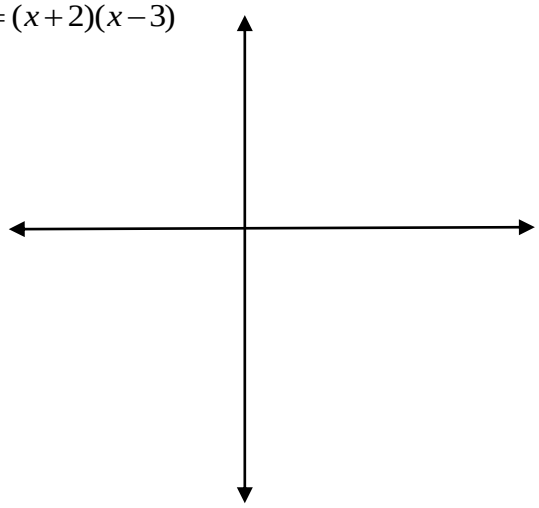


Draw x and y axis and draw the graph of a quadratic function below giving its equation in the form $y=(x+r)(x+s)$.

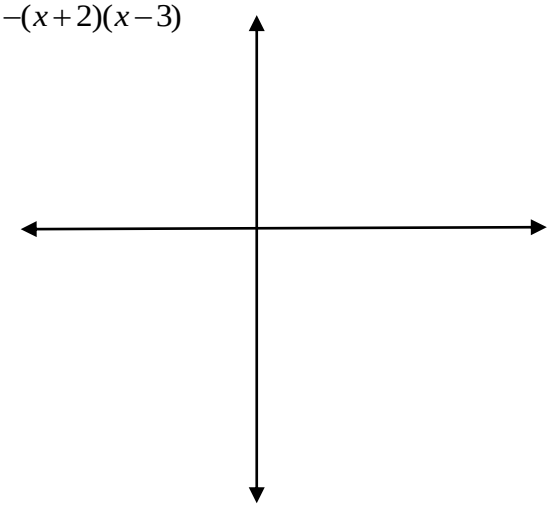
Student Activity 3a

Working in pairs, **sketch** the following graphs on the axes below.
Note particularly the intercepts on the axes and whether the graph has a local maximum or local minimum. (Check the sign of y values for x values between the roots.)
Verify that you are correct by using a graphing calculator or graphing software such as GeoGebra if you have access to these. Alternatively use the "Table" mode on your calculator to verify points.

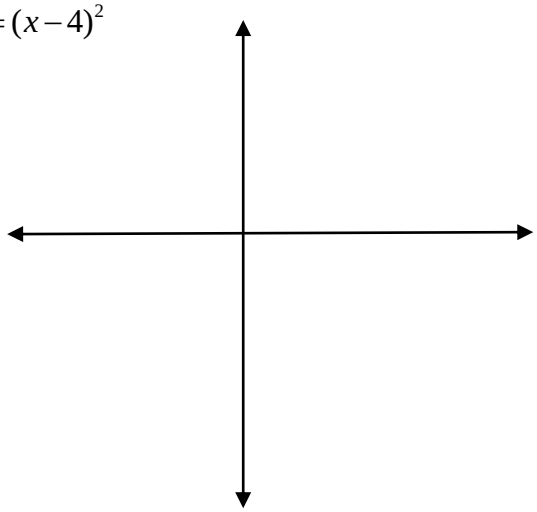
$y=(x+2)(x-3)$



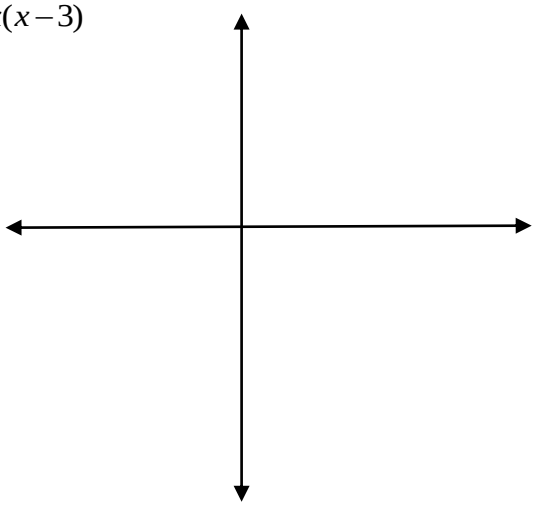
$y=-(x+2)(x-3)$



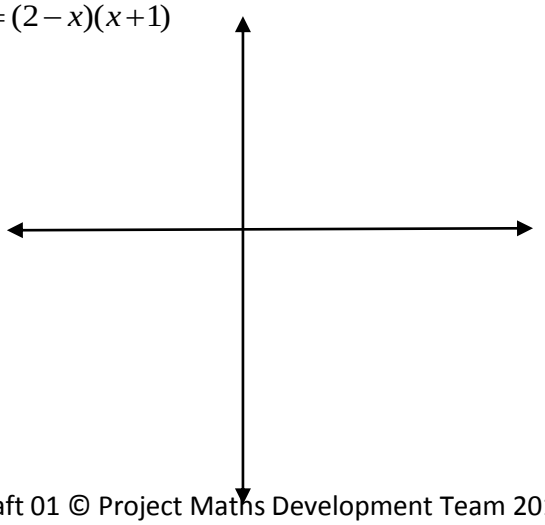
$y=(x-4)^2$



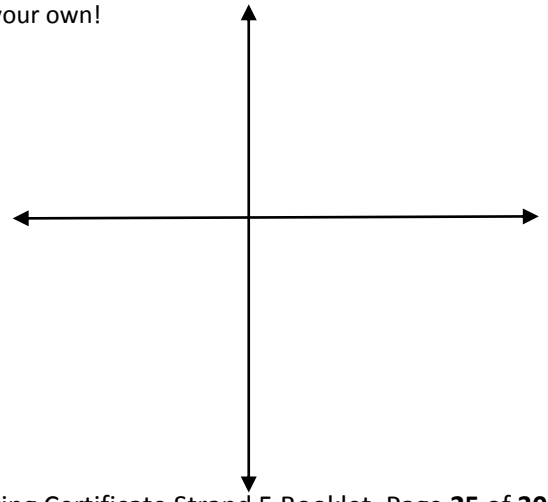
$y=x(x-3)$



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



Add your own!



Student Activity 4

Project Maths Tionscadal Mata Development Team

Matching cards activity: Match the cards into 7 sets taking one card from each group. Discuss reasoning and be able to explain decisions.

Set A

1. $y=(x-3)(x-3)$	2. $y=(x+2)(x+4)$	3. $y=(x+1)(3-x)$
4. $y=(x-2)(6-x)$	5. $y=(x-4)(x+2)$	6. $y=(x-4)(x-6)$

Set B

7. $y=-x^2+2x+3$	8. $y=x^2+6x+8$	9. $y=x^2-6x+9$
10. $y=x^2-10x+24$	11. $y=x^2-2x-8$	12. $y=-x^2+8x-12$

Set C

13. $y=(x-5)^2-1$	14. $y=-(x-4)^2+4$	15. $y=(x-1)^2-9$
16. $y=-(x-1)^2+4$	17. $y=(x+3)^2-1$	18. $y=(x-3)^2$

Set D

19. $x=0, y=9$	20. $x=0, y=8$	21 $x=0, y=-8$
22. $x=0, y=-12$	23. $x=0, y=3$	24. $x=0, y=24$

Set E

25. $y=0$, $x=-1$ or 3	26. $y=0$, $x=-2$ or $+4$	27. $y=0$, $x=2$ or 6

Student Activity 4

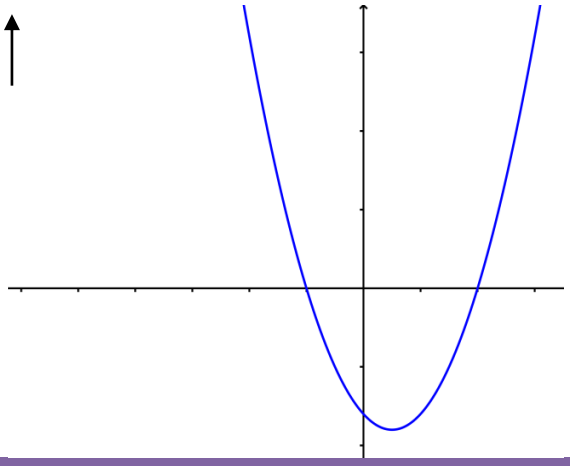
28. $y=0,$ $x=4$ or 6	29. $y=0,$ $x=3$	30. $y=0,$ $x=-2$ or -4

Set F

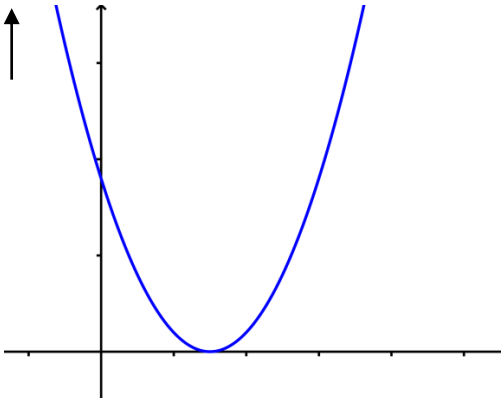
31. local maximum at (1,4)	32. local minimum at (5,-1)	33. local minimum at (1,-9)
34. local minimum at (-3,-1)	35. local maximum at (4,4)	36. local minimum at (3,0)

Set 7

37.

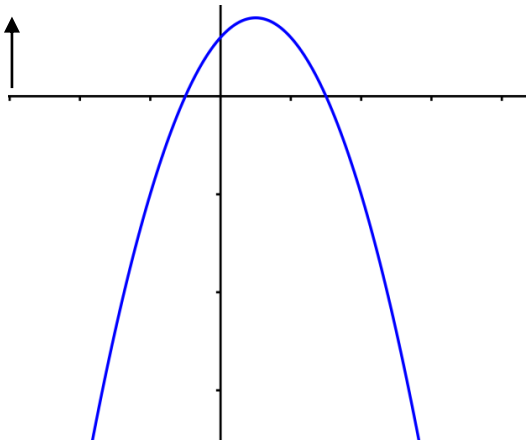


38.



Student Activity 4

39.



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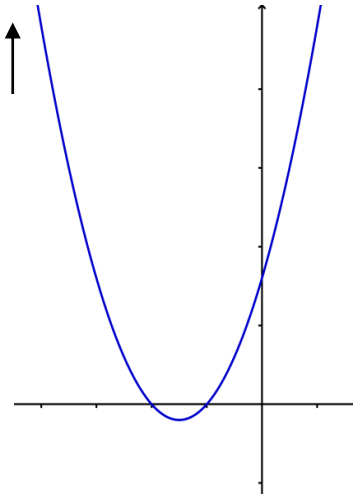
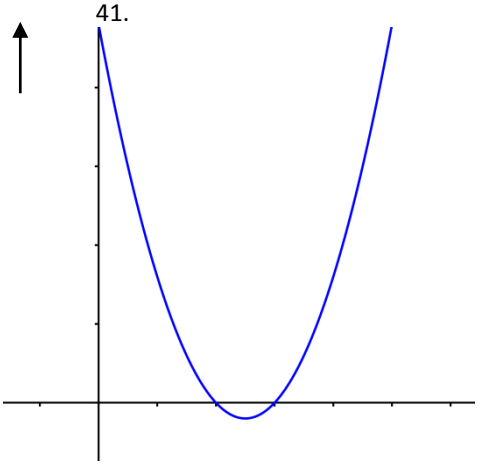
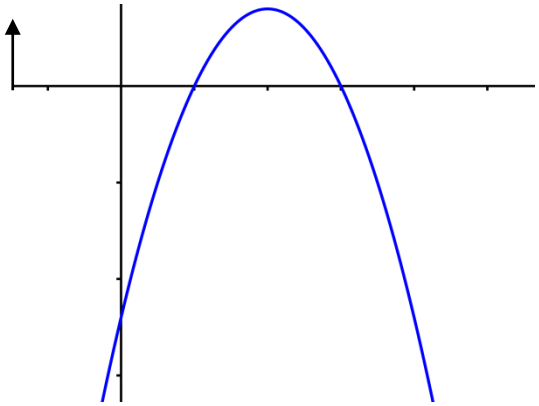


41.

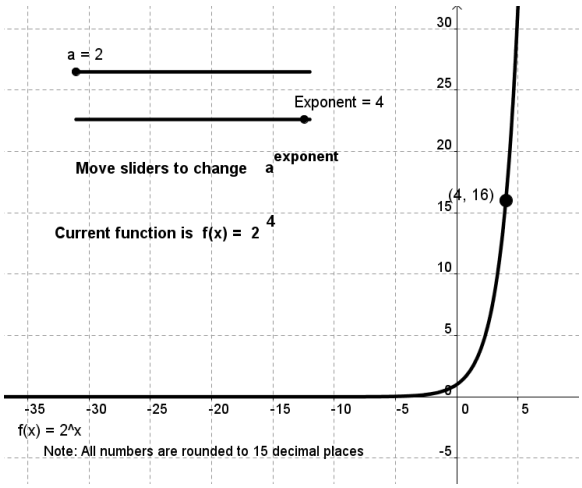


42.



Student Activity: To investigate a^n

Use in connection with the interactive file, 'Exponential Function', on the student's CD.

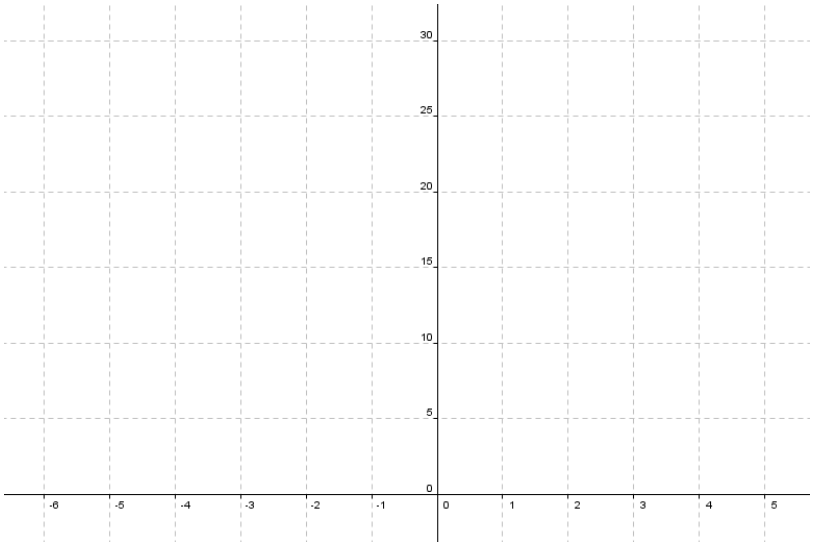


1.

a. Complete the following table:

x	2^x
5	
4	
3	
2	
1	
0	
-1	
-2	
-3	
-4	

b. Draw the graph of the data represented in the table above.



c. This graph is getting closer and closer to the *x* axis. Will it ever touch it? Explain.

_____

d. Is this an example of a linear, quadratic or exponential function? Explain your reason.

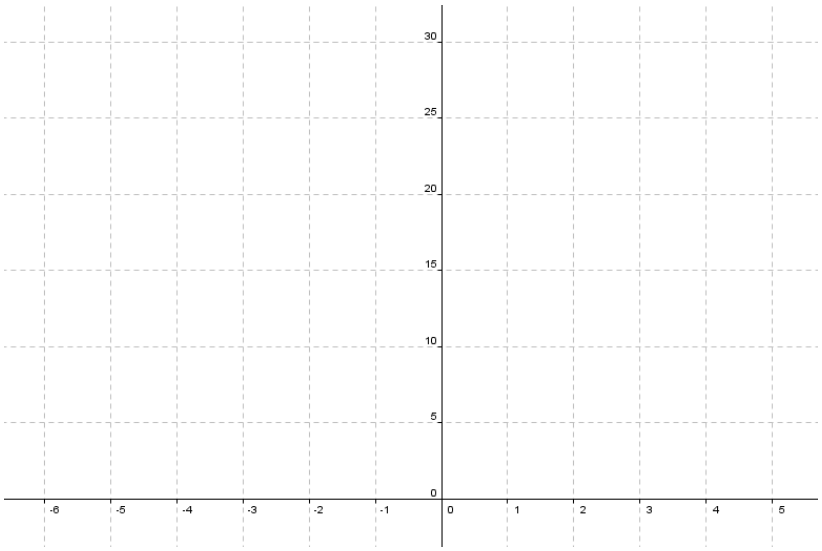
_____

2.

a. Complete the following table:

x	3^x
3	
2	
1	
0	
-1	
-2	
-3	
-4	

b. Draw the graph of the data represented in the table above.



c. What do you notice about the graph for values of *x* less than one?

_____

d. This graph is getting closer and closer to the *x* axis. Will it ever touch it? Explain.

_____

e. Is this an example of a linear, quadratic or exponential function? Explain your reason.

_____