Bunbury SHS Assessment Task Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mathematics Methods 1 | Unit 1

Investigation 1 – Graphs and transformations

## Part A: Preparation activities

**Materials required:** Standard writing equipment

Calculator with graphing facilities (to be provided by the student)

**Other materials allowed:** Drawing templates

**Task weighting: 6%** (allfrom Part B: In-Class Validation)

**Activity 1: Lines and linear relationships**

(a) For values of  between -10 and 10 i.e.  and for values of  between -10   
and 10 i.e., plot the functions listed and complete the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | -intercept | -intercept | gradient | Rank these lines from 1–6  in order of steepness  (6 is the steepest) |
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What is the relationship between the gradient and the steepness of the line?

How is the position of the line, in relation to the -axis, influenced by the gradient?

(b) For and , plot the functions listed and complete the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Function | -intercept | -intercept | gradient | Rank these lines from 1–6  in order of steepness  (6 is the steepest) |
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What is the relationship between the gradient and the steepness of the line?

How is the position of the line, in relation to the -axis, influenced by the gradient?

Is it true to say ‘The higher the gradient, the steeper the line’?

Explain how the gradient influences the steepness of the line in terms of changes in theand values.

(c) The line  is a mirror image of.

(i) What does this mean?

(ii) What is the line of reflection?

(iii) Is the line  always a reflection of? Explain your answer.

(iv) Which of the following represents the reflection of  about the *x*-axis?



(d) For and , sketch the functions listed.



(i) Describe how the graphs of these lines are influenced by the algebraic rules.

(ii) For the rules given in (d) (i), if the constant was subtracted from the  rather than added, how would the graphs differ?

(iii) How does the graph of  differ from that of ? In what ways are the two graphs similar?

(e) For and , sketch the functions listed.



(i) The graph of  is a translation of. What is a translation?

How is the horizontal position of the graph of different from that of?

(ii) A general rule for these linear functions is where.

Do all such lines have the same gradient? Explain.

What is the -intercept for each of these lines?

What is the -intercept for each of these lines?

Describe the influence of  on the position of these lines along the -axis.

(iii) Give the formulae for four different linear functions of the form where. How will the graphs of these functions differ from that of? What is the influence of  on the translations that have occurred?

(f) What is the rule for the function produced when the graph of

(i) is reflected over the -axis?

(ii) is translated vertically 5 units down?

(iii) is translated 5 units horizontally to the right?

**Activity 2: Quadratic relationships**

(a) Sketch the following functions for and .



(b) Compared to the parabola , how is the graph of  different when

(i)  > 1?

(ii) ?

(c) Sketch the following functions for and .



(d) What transformation of the graph of occurs when is multiplied by -1?

(e) Sketch the following functions for and .

(i) 

(ii) 

(f) Describe the transformation that occurs when varies in the function.

Consider the range of values that  can take.

(g) Sketch the following functions for and .

(i) 

(ii) 

(h) For each graph for the functions in part (g), determine the

(i) turning point

(ii) -intercept(s)

(iii) line of symmetry

(iv) -intercept.

(i) For the graph of the function , as  varies

(i) describe the translation that occurs

(ii) what features of the graph are unchanged?

(iii) compare the graph of the function with that of in terms of the features listed in   
part (h).

**Activity 3: Transformations**

(a) Reflect the graph over the -axis

The rule for the graph which is a reflection over the -axis ofis.

To reflect these functions over the -axis, what would be the rule?

Test your rule by sketching both functions.

(i)  (ii)  (iii)  (iv)  (v) 

(b) Vertical translation

The rule for the graph which is a vertical translation down 4 units of is.

To translate these functions vertically up by 3 units, what would be the rule?

Test your rule by sketching both functions.

(i)  (ii)  (iii)  (iv) 

(c) Horizontal translation

The rule for the graph which is a horizontal translation left 4 units of is.

To translate these functions horizontally left by 4 units, what would be the rule?

Test your rule by sketching both functions.

(i)  (ii)  (iii)  (iv) 

(d) Increasing the steepness of a graph

Consider the graph of function.

(i) Write a rule that will produce a graph that is similar but steeper.

(ii) Write a rule that will produce a graph that is similar but not as steep.

Test these rules.

**Activity 4**

Consider the results from the earlier activities. What changes to the rules for these functions are necessary to produce the following changes to their graphs?

(a) Reflect the graph over the -axis.

(b) Translate the graph vertically by *m* units.

(c) Translate the graph horizontally by *m* units.

(d) Increase the steepness of the graph.