

Performance Tasks for Part 2

Functions

THE FOLLOWING ACTIVITIES SHOULD EACH TAKE LESS THAN A PERIOD TO COMPLETE.

1. Studying Functions

Analyze two of the following functions in depth. Include:

- the domain and range
- the relationship to the base graph, including applied transformations
- any lines of symmetry
- the inverse of the function

Include diagrams and graphs as well as written and algebraic responses in your analysis.

(a) $y = 2\sqrt{x + 4}$

(b) $y = 3x^2 - 24x + 50$

(c) $y = 3 - \sqrt{x}$

2. The Cost of Money

The value of a Canadian dollar in U.S. dollars often changes. Suppose one U.S. dollar is worth \$1.48 Canadian.

- Express the relationship as an equation.
- Graph the equation and its inverse, by hand and using technology.
- Explain the meaning of the inverse relationship and find its equation.
- Suppose a Canadian shopping at a U.S. store sees a sign that Canadian dollars will be discounted by 40%. Is this a good deal? Explain.

Research Extension (Extra Time)

- Find the current values of the U.S. and Canadian dollars and create the exchange equations.

3. Exponential Equations

Demonstrate how to solve exponential equations both graphically and algebraically. Use these equations as models:

(a) $2^{-2x} = 4$

(b) $2^{4x - 2} = 8^x$

(c) $4^{x + 3} = 8^{2x}$

4. Graphing Complex Numbers

A complex number in the form $x + yi$ can be graphed as the ordered pair (x, y) .

- (a) Graph the complex number $2 + 3i$ as an ordered pair $(2, 3)$. Label this point A .
- (b) Graph the complex number $-3 + 4i$ as an ordered pair. Label this point B .
- (c) Label the origin O . Draw line segments OA and OB .
- (d) Draw two lines, one through A parallel to OB , and one through B parallel to OA .
- (e) Find the intersection point of the two lines you drew in (d).
- (f) What relationship does this point have to points A and B ?
- (g) Make a conjecture and test it using several different complex numbers as points.

5. Graphing Equations

Part I

- (a) Match each equation to its graph. The scales are the same on all graphs. Explain your reasoning in each case.
- (b) State the domain and range of each relation. Note: You should be able to do this question without graphing technology.

i. $y = -2(x - 2)^2 + 3$

ii. $y = 2^x + 1$

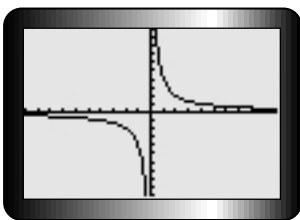
iii. $y = 2(x + 1)^2 - 2$

iv. $y = -3\sqrt{x - 1} + 2$

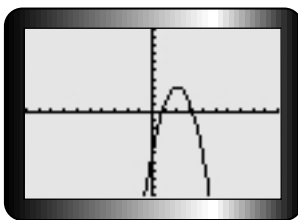
v. $y = \frac{4}{x}$

vi. $y = 2\sqrt{x + 1}$

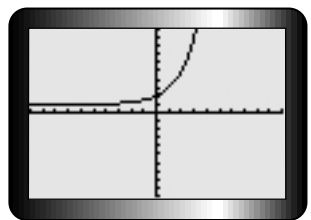
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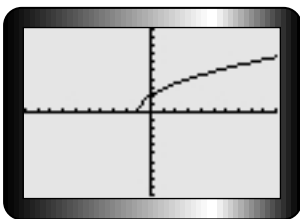
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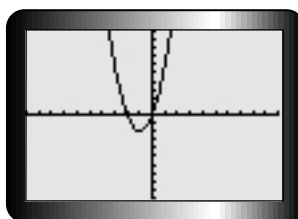
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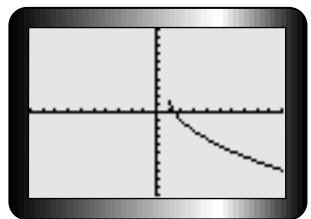
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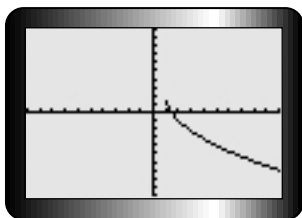


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Part II

Create an equation for the following graph. (Note that in this calculator screen, the x and y -axes both go from -10 to 10 .) Explain how you determined the equation.



6. Chartering a Flight

Westtown Secondary School band wants to fly to Vancouver for a music competition. The Fly-Rite charter company gives the band this information.

Number on Trip	25	40	50	60	80	100
Cost per Person	\$960	\$600	\$480	\$400	\$300	\$240

Another company, Straight-Away Charters, charges a flat fee of \$10 000, plus \$200 per person.

(a) Copy and complete the table.

Number on Trip	30	40	50	75	100
Cost per Person		\$450			

- (b) Graph both relations on the same set of axes. Use “number on trip” as the independent variable and “cost per person” as the dependent variable.
- (c) Describe and compare the relations.
- (d) Create an equation to describe each relation.
- (e) How many students would need to take the trip for the costs to be equal? Verify your answer algebraically.
- (f) Straight-Away increases its per-person charge to \$250 per person. How would this increase effect your graph?
- (g) Given the new rate, discuss whether Fly-Rite or Straight-Away offers the better deal.

7. Fractals

Fractal geometry creates many interesting designs and patterns. One of the techniques used in fractal geometry is called an iterative technique. This technique starts with a single value, such as 2, that is substituted and evaluated in a given function, such as $f(x) = 2x + 1$. The result, in this case 5, is then also substituted in the given function $f(x)$. In this case, the result of the second iteration would be 11.

- (a) Find the first three iterates (values after three iterations) when the initial value of x is 2 and the function is $f(x) = x^2 - 1$.
- (b) Fractals are also generated by using a complex number as the initial value. Use $z = 2 + 3i$ as the initial value and $f(z) = z^2 + (-1 + 2i)$ and determine the values for the first three iterates. Clearly show how you are obtaining the values.
- (c) The result after the first iteration of $g(z) = 2z + (4i - 5)$ is $-7 + 5i$. What was the initial value?

Research Extension (Extra Time)

- (d) Now that you have the mathematics behind fractals, research and report how fractal designs use this technique to generate patterns.

THE FOLLOWING ACTIVITIES SHOULD EACH TAKE MORE THAN A PERIOD TO COMPLETE.

8. Presenting Math

Create a presentation to teach other students everything they need to know about at least one of the following transformations: translations, reflections, or stretches. Your presentation should

- i. include visuals and the use of technology for graphing
- ii. clearly link the graph of a relation under a transformation with the algebraic expression for that relation
- iii. make use of at least three different base graphs chosen from: $y = x$, $y = x^2$, $y = \sqrt{x}$, $y = \sin x$, or $y = \cos x$

9. Demonstrating Math

You have been chosen to demonstrate what you have learned in math class for the upcoming parents' night. You know that many of the parents of your friends in the class struggled to help with homework on "word problems." You are to create a presentation to demonstrate how to use quadratic modelling to solve problems. Your presentation should include well-organized instructions, steps, and hints as to how to use both algebraic and graphical solutions. You should use at least two of these problems as samples to guide the presentation.

- (a) A total of 800 m of fencing material is used to enclose a rectangular field and to divide the field into four portions by fences parallel to one of the sides of the field. Find the maximum area that can be enclosed in this rectangle and state the dimensions of the rectangle.
- (b) A charter company will provide a plane for a fare of \$200 each for 80 or fewer passengers. For each passenger over the 80-person mark, the fare is decreased by \$2 per person for everyone. What number of passengers would produce the greatest revenue for the company?

10. How Fast?

Kim and Julie are joining Nicole at her parents' cottage for the weekend. The cottage is 150 km away from their neighbourhood. Kim can leave directly after school but Julie will be leaving after band practice, an hour and a quarter later. Kim took her time and drove slowly, averaging 20 km/h slower than Julie. They both arrived there at the same time. At what speeds were they travelling?