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2.1 Transformers: Shifty y's

A Develop Understanding Task

Start on
lesson 2.1

Optima Prime is designing a robot quilt for her new grandson. She plans for the robot to have a square face. The amount of fabric that she needs for the face will depend on the area of the face, so Optima decides to model the area of the robot's face mathematically. She knows that the area A of a square with side length x units (which can be inches or centimeters) is modeled by the function, $A(x) = x^2$ square units.

- What is the domain of the function $A(x)$ in this context?
all positive $x \geq 0$
- Match each statement about the area to the function that models it:

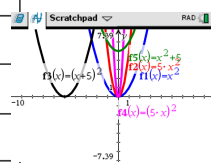
Matching Equation (A, B, C, or D)	Statement	Function Equation
<i>B</i>	The length of each side is increased by 5 units.	A $A(x) = 5x^2$
<i>C</i>	The length of each side is multiplied by 5 units.	B $A = (x + 5)^2$
<i>D</i>	The area of a square is increased by 5 square units.	C $A = (5x)^2$
<i>A</i>	The area of a square is multiplied by 5.	D $A = x^2 + 5$

Optima started thinking about the graph of $y = x^2$ (in the domain of all real numbers) and wondering about how changes to the equation of the function like adding 5 or multiplying by 5 affect the graph. She decided to make predictions about the effects and then check them out.

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- Predict how the graphs of each of the following equations will be the same or different from the graph of $y = x^2$.

Equation	Similarities to the graph of $y = x^2$	Differences from the graph of $y = x^2$
$y = 5x^2$	<i>y-intercept (0,0) U-shape, Quad, Parabola positive</i>	<i>steeper, thinner, or taller</i>
$y = (x + 5)^2$		<i>shift left</i>
$y = (5x)^2$		<i>skinnier, narrow</i>
$y = x^2 + 5$		<i>up</i>



- Optima decided to test her ideas using technology. She thinks that it is always a good idea to start simple, so she decides to go with $y = x^2 + 5$. She graphs it along with $y = x^2$ in the same window. Test it yourself and describe what you find.

up 5

- Knowing that things make a lot more sense with more representations, Optima tries a few more examples like $y = x^2 + 2$ and $y = x^2 - 3$, looking at both a table and a graph for each. What conclusion would you draw about the effect of adding or subtracting a number to $y = x^2$? Carefully record the tables and graphs of these examples in your notebook and explain why your conclusion would be true for any value of k , given, $y = x^2 + k$.

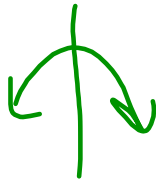
shifting up (+) down (-)

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6. After her amazing success with addition in the last problem, Optima decided to look at what happens with addition and subtraction inside the parentheses, or as she says it, "adding to the x before it gets squared". Using your technology, decide the effect of h in the equations: $y = (x + h)^2$ and $y = (x - h)^2$. (Choose some specific numbers for h .) Record a few examples (both tables and graphs) in your notebook and explain why this effect on the graph occurs.

$(x+5)^2$ left
 $(x+2)^2$ left
 $(x-3)^2$ right
OPPOSITE!

7. Optima thought that #6 was very tricky and hoped that multiplication was going to be more straightforward. She decides to start simple and multiply by -1 , so she begins with $y = -x^2$. Predict what the effect is on the graph and then test it. Why does it have this effect?



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READY, SET, GO!

Name

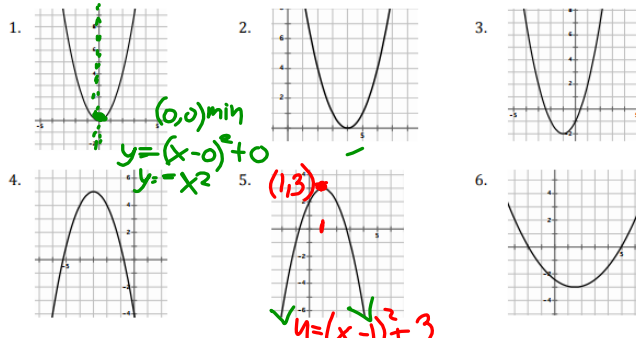
Period

Date

READY

Topic: Finding key features in the graph of a quadratic equation

Make a point on the vertex and draw a dotted line for the axis of symmetry. Label the coordinates of the vertex and state whether it's a maximum or a minimum. Write the equation for the axis of symmetry.

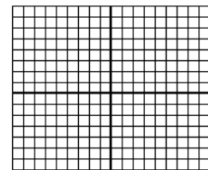


7. What connection exists between the coordinates of the vertex and the equation of the axis of symmetry?

8. Look back at #6. Try to find a way to find the exact value of the coordinates of the vertex. Test your method with each vertex in 1 - 5. Explain your conjecture.

9. How many x -intercepts can a parabola have?

10. Sketch a parabola that has no x -intercepts, then explain what has to happen for a parabola to have no x -intercepts.



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SET

Topic: Transformations on quadratics

Matching: Choose the area model that is the best match for the equation.

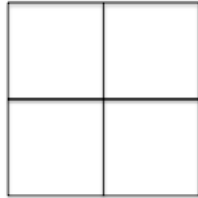
___11. $x^2 + 4$

___12. $(x + 4)^2$

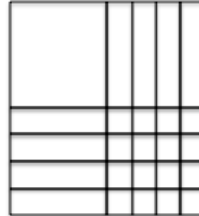
___13. $(4x)^2$

___14. $4x^2$

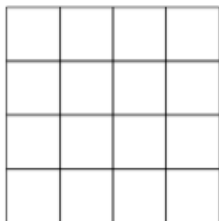
a.



b.



c.

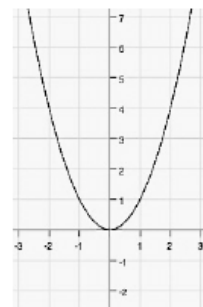


d.



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A table of values and the graph for $f(x) = x^2$ is given. Compare the values in the table for $g(x)$ to those for $f(x)$. Identify what stays the same and what changes. a) Use this information to write the vertex form of the equation of $g(x)$. b) Graph $g(x)$. c) Describe how the graph changed from the graph of $f(x)$. Use words such as right, left, up, and down. d) Answer the question.

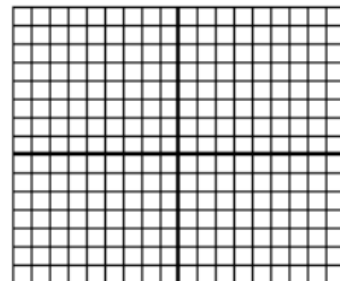


x	-3	-2	-1	0	1	2	3
$f(x) = x^2$	9	4	1	0	1	4	9

15 a) $g(x) =$

x	-3	-2	-1	0	1	2	3
$g(x)$	2	-3	-6	-7	-6	-3	2

b)



c) In what way did the graph move?

d) What part of the equation indicates this move?

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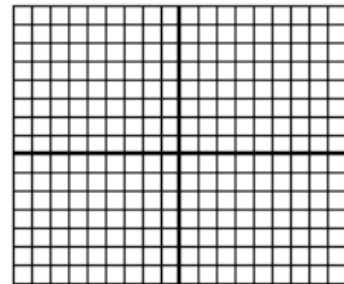
SECONDARY MATH II // MODULE 2
STRUCTURES OF EXPRESSIONS - 2.1

2.1

16 a) $g(x) =$

x	-3	-2	-1	0	1	2	3
$g(x)$	11	6	3	2	3	6	11

b)

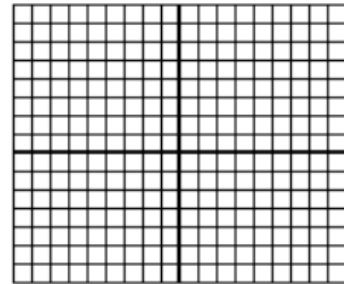


- c) In what way did the graph move?
- d) What part of the equation indicates this move?

17 a) $g(x) =$

x	-4	-3	-2	-1	0	1	2
$g(x)$	9	4	1	0	1	4	9

b)



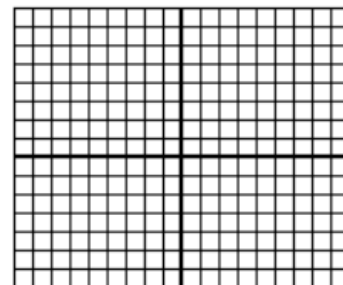
- c) In what way did the graph move?
- d) What part of the equation indicates this move?

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18 a) $g(x) =$

x	0	1	2	3	4	5	6
$g(x)$	9	4	1	0	1	4	9

b)



- c) In what way did the graph move?
- d) What part of the equation indicates this move?

GO

Topic: Finding Square Roots

Simplify the following expressions

$x^2 \rightarrow \sqrt{\quad}$

19. $\sqrt{49a^2b^6}$

$\sqrt{49} \sqrt{a^2} \cdot \sqrt{b^6} = 7 \cdot a \cdot b^3 = 7ab^3$

20. $\sqrt{(x+13)^2}$

$x+13$

21. $\sqrt{(x-16)^2}$

22. $\sqrt{(36x+25)^2}$

23. $\sqrt{(11x-7)^2}$

24. $\sqrt{9m^2(2p^3-q)^2}$

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