

2.5 Be There or Be Square

A Practice Understanding Task



CC BY David A

Quilts and Quadratic Graphs

Optima's niece, Jenny works in the shop, taking orders and drawing quilt diagrams. When the shop isn't too busy, Jenny pulls out her math homework and works on it. One day, she is working on graphing parabolas and notices that the equations she is working with looks a lot like an order for a quilt block. For instance, Jenny is supposed to graph the equation: $y = (x - 3)^2 + 4$. She thinks, "That's funny. This would be an order where the length of the standard square is reduced by 3 and then we add a little piece of fabric that has as area of 4. We don't usually get orders like that, but it still makes sense. I better get back to thinking about parabolas. Hmmm..."

1. Fully describe the parabola that Jenny has been assigned to graph.

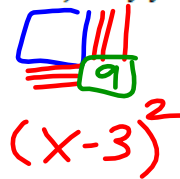
right 3 UP 4 parabola, U-shape positive, open up.
 height pattern $\rightarrow 1^2, 2^2, 3^2, 4^2$
 $1, 4, 9, 16$

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2. Jenny returns to her homework, which is about graphing quadratic functions. Much to her dismay, she finds that she has been given: $y = x^2 - 6x + 9$. "Oh dear", thinks Jenny. "I can't tell where the vertex is or identify any of the transformations of the parabola in this form. Now what am I supposed to do?"



"Wait a minute—is this the area of a perfect square?" Use your work from *Building the Perfect Square* to answer Jenny's question and justify your answer.



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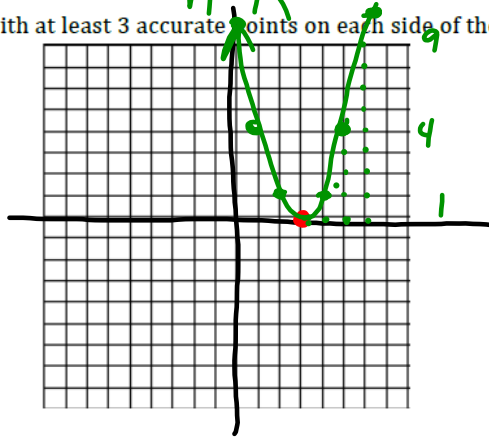
3. Jenny says, "I think I've figured out how to change the form of my quadratic equation so that I can graph the parabola. I'll check to see if I can make my equation a perfect square." Jenny's equation is: $y = x^2 - 6x + 9$.

See if you can change the form of the equation, find the vertex, and graph the parabola.

- a. $y = x^2 - 6x + 9$ New form of the equation: $(x-3)^2 + 0$
right

- b. Vertex of the parabola: $(3, 0)$
h k

- c. Graph (with at least 3 accurate points on each side of the line of symmetry):

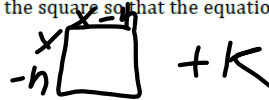


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4. The next quadratic to graph on Jenny's homework is $y = x^2 + 4x + 2$. Does this expression fit the pattern for a perfect square? Why or why not?

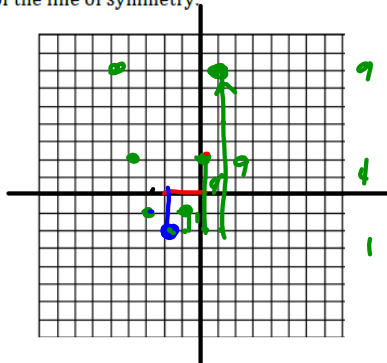
$(x+2)^2 - 2$
down 2

- a. Use an area model to figure out how to complete the square so that the equation can be written in vertex form, $y = a(x-h)^2 + k$.



- b. Is the equation you have written equivalent to the original equation? If not, what adjustments need to be made? Why?

- c. Identify the vertex and graph the parabola with three accurate points on both sides of the line of symmetry.



$(x+2)^2 - 2$
left 2

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

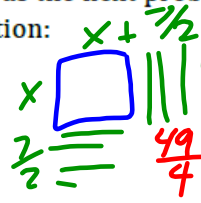
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5. Jenny hoped that she wasn't going to need to figure out how to complete the square on an equation where b is an odd number. Of course, that was the next problem. Help Jenny to find the vertex of the parabola for this quadratic function:

$$g(x) = x^2 + 7x + 10$$

$$\left(x^2 + 7x + \frac{49}{4}\right) + 10 - \frac{49}{4}$$

$$\left(x + \frac{7}{2}\right)^2 - \frac{9}{4}$$



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6. Don't worry if you had to think hard about #5. Jenny has to do a couple more:

a. $g(x) = x^2 - 5x + 3$

b. $g(x) = x^2 - x - 5$

$$\left(x^2 - 5x + \frac{25}{4}\right) + 3 - \frac{25}{4}$$

$$\left(x - \frac{5}{2}\right)^2 - \frac{13}{4}$$

$$\left(x^2 - x + \frac{1}{4}\right) - \frac{5}{4} - \frac{1}{4}$$

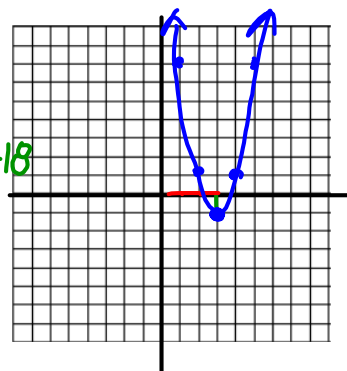
$$\left(x - \frac{1}{2}\right)^2 - \frac{3}{2}$$

7. It just gets better! Help Jenny find the vertex and graph the parabola for the quadratic function: $h(x) = 2x^2 - 12x + 17$

$$2(x^2 - 6x + 9) + 17 - 18$$

$$2(x - 3)^2 - 1$$

right 3 down 1



$$16 - 2 = 14$$

$$9 - 2 = 7$$

$$4 - 2 = 2$$

$$1 - 2 = -1$$

8. This one is just too cute—you've got to try it! Find the vertex and describe the parabola that is the graph of: $f(x) = \frac{1}{2}x^2 + 2x - 3$

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READY, SET, GO! Name _____ Period _____ Date _____

READY

Start on homework, while stamping

Topic: Recognizing Quadratic Equations

Identify whether or not each equation represents a quadratic function. Explain how you knew it was a quadratic. *x(2) ← quad. (in the resulting equation)*

1. $x^2 + 13x - 4 = 0$

Quadratic or no? *yes*

Justification:

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

Quadratic or no? *NO they cancel*

Justification:

3. $x(4x - 5) = 0$

Quadratic or no?

Justification:

4. $(2x - 7) + 6x = 10$

Quadratic or no?

Justification:

5. $2^x + 6 = 0$

Quadratic or no?

Justification:

6. $32 = 4x^2$

Quadratic or no?

Justification:

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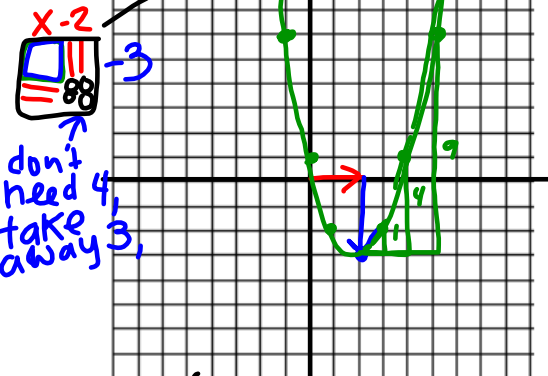
SET

Topic: Changing from standard form of a quadratic to vertex form.

Change the form of each equation to vertex form: $y = a(x - h)^2 + k$. State the vertex and graph the parabola. Show at least 3 accurate points on each side of the line of symmetry.

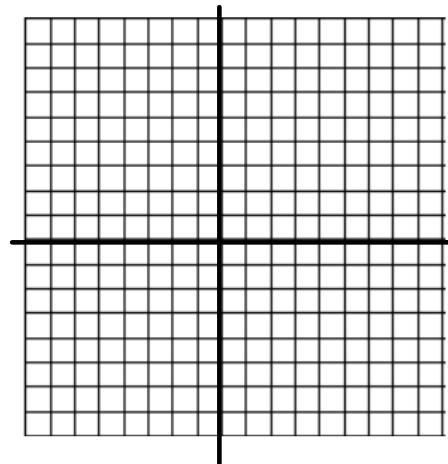
7. $y = x^2 - 4x + 1 = (x - 2)^2 - 3$

vertex: *(2, -3)*



8. $y = x^2 + 2x + 5$

vertex:



Option 2: $(x^2 - 4x + (-2)^2) + 1 - 4$

1	x^2
2	$2x$
3	$3x^2$
4	$4x^2$

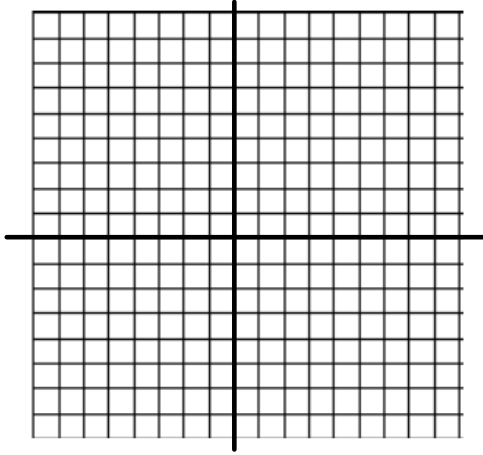
$(x - 2)^2 - 3$

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SECONDARY MATH II // MODULE 2
STRUCTURES OF EXPRESSIONS - 2.5

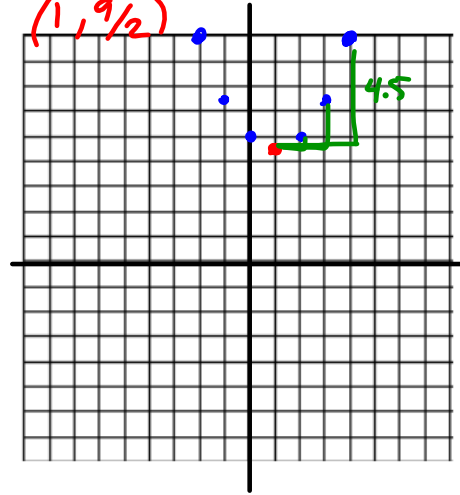
9. $y = x^2 + 3x + \frac{13}{4}$

vertex:



10. $y = \frac{1}{2}x^2 - x + 5$
 $\frac{1}{2}(x^2 - 2x + 1) + 5 - \frac{1}{2}$
 $\frac{1}{2}(x-1)^2 + \frac{9}{2} \sim 4.5$
 vertex: $(1, 9/2)$

over up
 1 1/2
 2 4/2
 3 9/2
 4 16/2



11. One of the parabolas in problems 9 - 10 should look "wider" than the others. Identify the parabola. Explain why this parabola looks different.

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Fill in the blank by completing the square. Leave the number that completes the square as an improper fraction. Then write the trinomial in factored form.

12. $x^2 - 11x + \frac{121}{4}$

13. $x^2 + 7x + \underline{\hspace{1cm}}$

14. $x^2 + 15x + \underline{\hspace{1cm}}$

$(x - \frac{11}{2})^2 + (\frac{11}{2})^2$

15. $x^2 + \frac{2}{3}x + \underline{\hspace{1cm}}$

16. $x^2 - \frac{1}{5}x + \underline{\hspace{1cm}}$

17. $x^2 - \frac{3}{4}x + \underline{\hspace{1cm}}$

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GO
Topic: Writing recursive equations for quadratic functions.

Identify whether the table represents a linear or quadratic function. If the function is linear, write both the explicit and recursive equations. If the function is quadratic, write only the recursive equation.

18.

x	f(x)
1	0
2	3
3	6
4	9
5	12

} +3
} +3
} +3

Type of function: *linear*

Equation(s): *rec:*
ex:

19.

x	f(x)	
0	-3	
1	7	0
2	10	3
3	16	6
4	25	9
5	37	12

} +3
} +3
} +3

Type of function: *Quad*

Equation(s): *rec: f(x) = f(x-1) + (3x-3)*

20.

x	f(x)
1	8
2	10
3	12
4	14
5	16

Type of function:

Equation(s):

21.

x	f(x)
1	28
2	40
3	54
4	70
5	88

Type of function:

Equation(s):

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GO
Topic: Writing recursive equations for quadratic functions.

Identify whether the table represents a linear or quadratic function. If the function is linear, write both the explicit and recursive equations. If the function is quadratic, write only the recursive equation.

18.

x	f(x)
1	0
2	3
3	6
4	9
5	12

} +3
} +3
} +3

Type of function: *linear*

Equation(s): *rec: f(x) = f(x-1) + 3*
ex: y = 3x + 0

19.

x	f(x)	
1	7	0
2	10	3
3	16	6
4	25	9
5	37	12

} +3
} +3
} +3

Type of function: *Quadratic*

Equation(s): *rec: f(x) = f(x-1) + (3x+0)*
directions: say only recursive if it is quad.
previous
Next in this sequence

20.

x	f(x)
1	8
2	10
3	12
4	14
5	16

Type of function:

Equation(s):

21.

x	f(x)
1	28
2	40
3	54
4	70
5	88

Type of function:

Equation(s):

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