Transforming Quadratic Functions

Name: NOTES

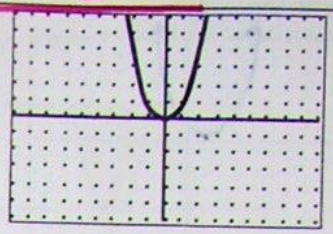
Sketch the graph each of the following equations. Set your calculator to the window to the right →

WINDOW
Xmin=-9
Xmax=9
Xscl=1
Ymin=-6
Ymax=6
Yscl=1
Xres=1

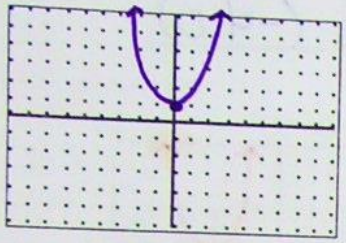
To turn on grid.... 2nd Format → GridOn

Parent Function

$f(x) = x^2$

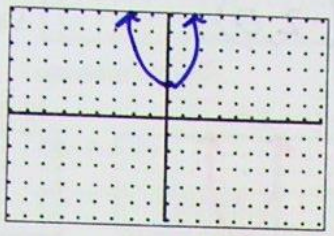


1. $Y_1 = x^2 + 1$



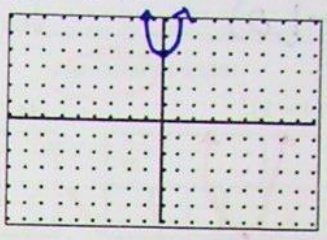
Vertex (0,1)

2. $Y_1 = x^2 + 2$



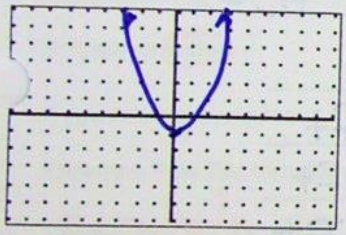
Vertex (0,2)

3. $Y_1 = x^2 + 4$



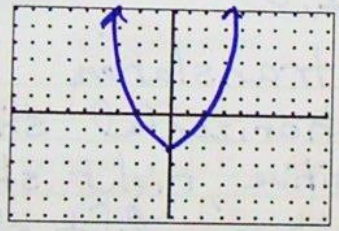
Vertex (0,4)

4. $Y_1 = x^2 - 1$



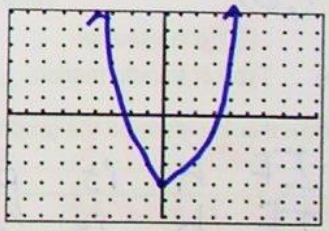
Vertex (0,-1)

5. $Y_1 = x^2 - 2$



Vertex (0,-2)

6. $Y_1 = x^2 - 4$



Vertex (0,-4)

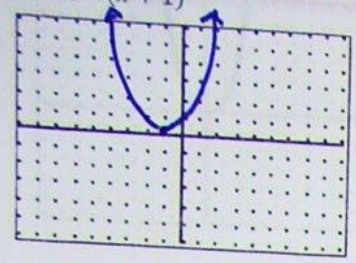
$f(x) + k$ Type of transformation: translation

Describe how this transformed the graph Vertical shift.

If K is positive, it shifts up.

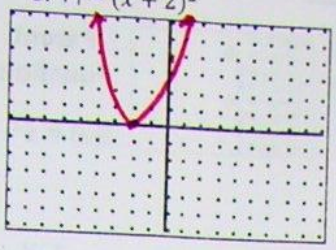
If K is negative, it shifts down.

7. $Y_1 = (x+1)^2$



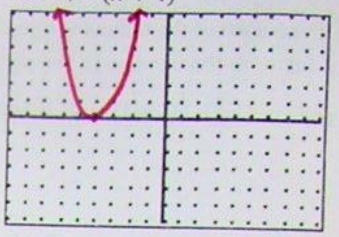
Vertex (-1, 0)

8. $Y_1 = (x+2)^2$



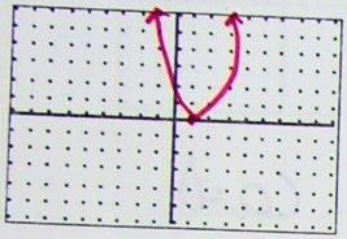
Vertex (-2, 0)

9. $Y_1 = (x+4)^2$



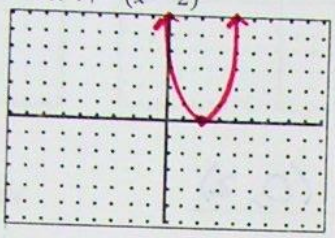
Vertex (-4, 0)

10. $Y_1 = (x-1)^2$



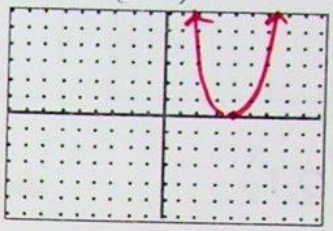
Vertex (1, 0)

11. $Y_1 = (x-2)^2$



Vertex (2, 0)

12. $Y_1 = (x-4)^2$



Vertex (4, 0)

$f(x \pm h)$ Type of transformation: translation

Describe how this transformed the graph horizontal shift

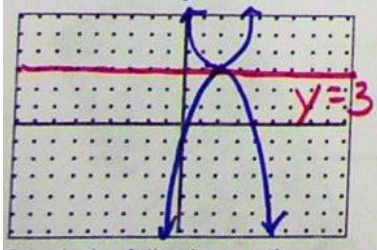
If h is positive, right shift

If h is negative, left shift

For the following equations, predict the vertex and then check your answer using your calculator.

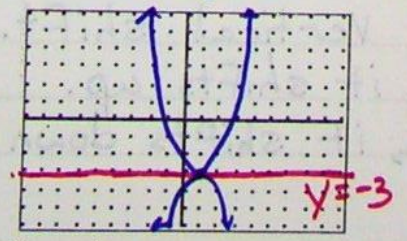
13. $Y_1 = (x-2)^2 + 3$

Vertex (2, 3)



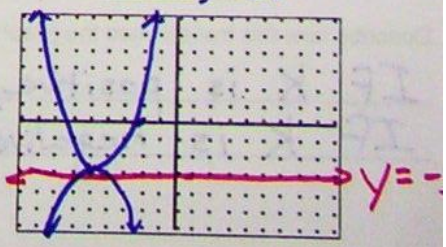
14. $Y_1 = (x-1)^2 - 3$

Vertex (1, -3)



15. $Y_1 = (x+5)^2 - 3$

Vertex (-5, -3)



Graph the following on the same grids as above.

13b. $Y_1 = -(x-2)^2 + 3$

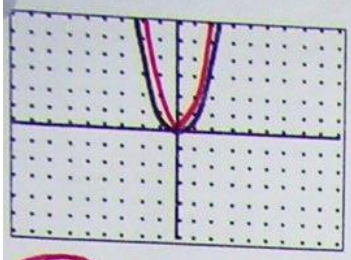
14b. $Y_1 = -(x-1)^2 - 3$

15b. $Y_1 = -(x+5)^2 - 3$

What transformation did the negative have on the graph? Reflection over y=k

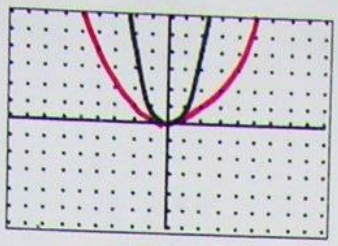
...the following to the graphed parent function, **f(x) = x^2**, by stating if it is narrower or wider.

19. $Y_1 = 2x^2$



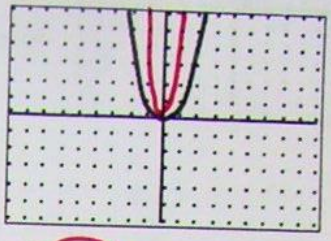
narrower or wider

20. $Y_1 = \frac{1}{4}x^2$



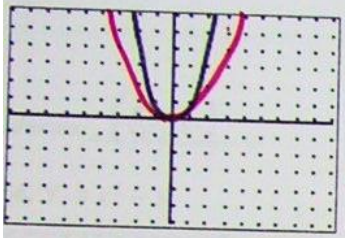
narrower or wider

21. $Y_1 = 8x^2$



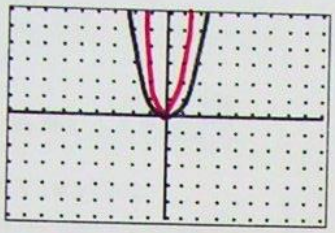
narrower or wider

22. $Y_1 = \frac{1}{2}x^2$



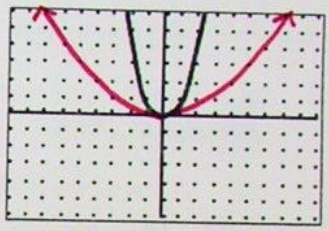
narrower or wider

23. $Y_1 = 3x^2$



narrower or wider

24. $Y_1 = \frac{2}{15}x^2$



narrower or wider

Type of transformation: dilation

Describe how this transformed the graph: If "a" is > 1, the parabola is narrower. If "a" is between 0 and 1, the parabola is wider

The vertex form of a quadratic function is given by $f(x) = a(x-h)^2 + k$.

- (h, k) is the vertex of the parabola
- x = h is the axis of symmetry
- The h represents a horizontal shift (how far right or left the graph has shifted from x = 0.)
- The K represents a vertical shift (how far up or down the graph has shifted from y = 0.)

...ven each equation, state the vertex, if it is turned up or down, if it is more narrow or wider than the parent ...ction, and describe the shift.

$y = 3(x-1)^2 + 5$ vertex: (1, 5) (up) or down (narrower) or wider Shifted: right 1, up 5

$y = -\frac{1}{2}(x+3)^2 - 4$ vertex: (-3, -4) up or (down) narrower or (wider) Shifted: left 3, down 4

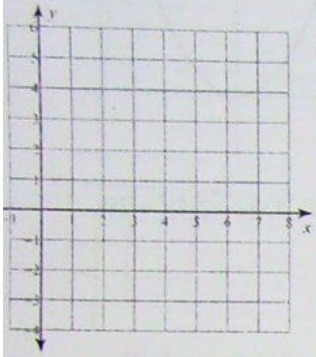
$= -2(x+6)^2 + 1$ vertex: (-6, 1) up or (down) (narrower) or wider Shifted: left 6, up 1

Name_____

Graphing Quadratics using Vertex Form

For each equation, state the vertical shift, the horizontal shift, the vertex, the axis of symmetry, if the parabola is turned up or down, and describe the dilation.

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



Vertical shift _____

Horizontal Shift _____

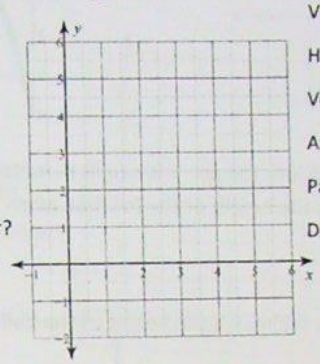
Vertex _____

Axis of Symmetry _____

Parabola Turned: up or down

Dilation: none, narrower, or wider?

2) $y = -\frac{1}{2}(x-4)^2 + 3$



Vertical shift _____

Horizontal Shift _____

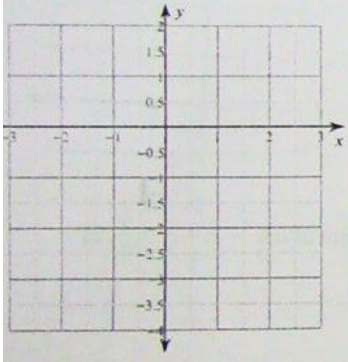
Vertex _____

Axis of Symmetry _____

Parabola Turned: up or down

Dilation: none, narrower, or wider?

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



Vertical shift _____

Horizontal Shift _____

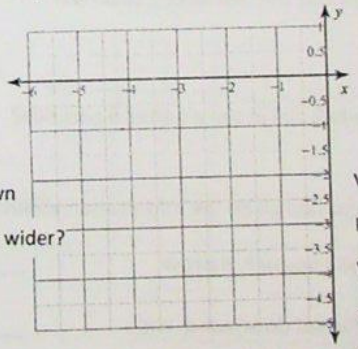
Vertex _____

Axis of Symmetry _____

Parabola Turned: up or down

Dilation: none, narrower, or wider?

4) $y = (x+2)^2 - 4$



Vertical shift _____

Horizontal Shift _____

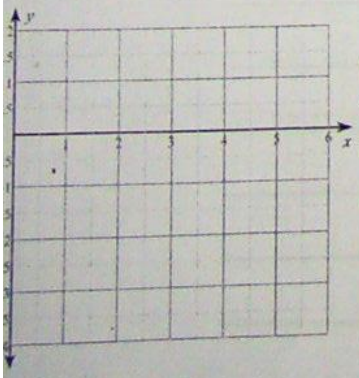
Vertex _____

Axis of Symmetry _____

Parabola Turned: up or down

Dilation: none, narrower, or wi

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



Vertical shift _____

Horizontal Shift _____

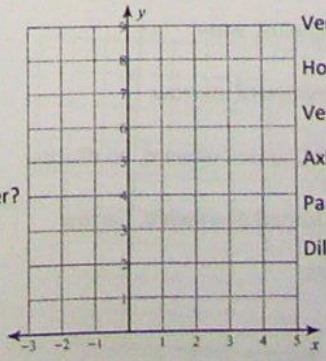
Vertex _____

Axis of Symmetry _____

Parabola Turned: up or down

Dilation: none, narrower, or wider?

6) $y = (x-3)^2 + 4$



Vertical shift _____

Horizontal Shift _____

Vertex _____

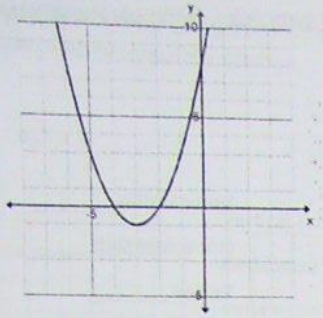
Axis of Symmetry _____

Parabola Turned: up or down

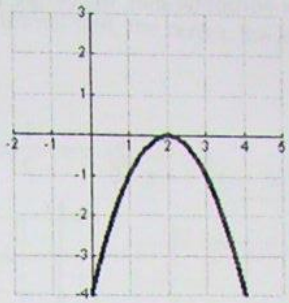
Dilation: none, narrower, or w

Write the equation of each parabola in vertex form.

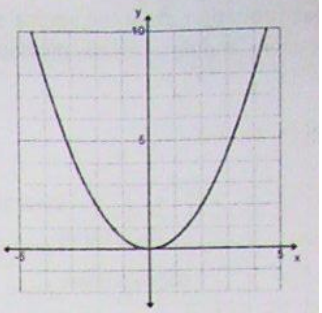
7. _____



8. _____



9. _____



10. A football is kicked into the air. It's height in meters after t seconds is given by $h = -4.9(t-2.4)^2 + 29$.

a) What was the height of the football when it was kicked?

b) What was the maximum height of the ball? At what time was the maximum height reached?

c) How high was the ball after 2 seconds?

d) Was the ball still in the air after 5 seconds?

-1

Write the vertex form of the equation given the information about the parabola. (limit the value of a to $-2, -\frac{1}{2}, 1, \frac{1}{2}, 2$)

13) Shifted 5 up and 7 left, turned upward, narrow _____

14) Shifted 4 down and 6 left, turned downward, wide _____

15) Shifted 3 up and 10 right, turned upward, no dilation _____

16) Shifted 6 down and 5 right, turned downward, no dilation _____

17) Shifted 1 down, turned upward, wide _____

18) Shifted 3 right, turned downward, narrow _____

19) Shifted 7 down and 1 right, turned upward, no dilation _____

20) Shifted 2 up and 10 left, turned downward, narrow _____