

Intermediate Algebra

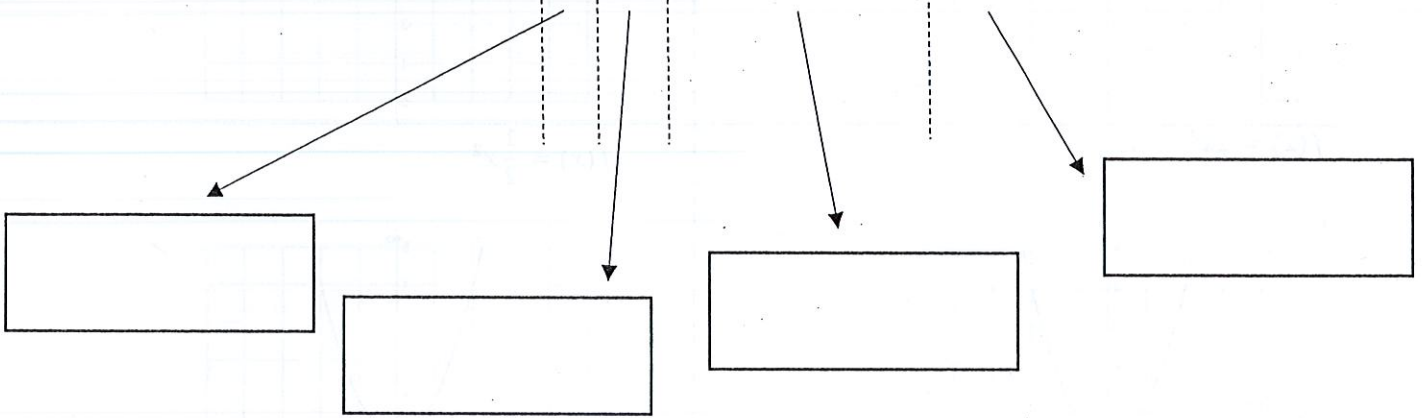
Unit 2 – Square Functions – Transformations of Quadratic Functions – Guided Notes

The Vertex Form of a Quadratic Function immediately gives you the vertex coordinate. It also tells you how the graph of the function is transformed.

All Quadratic Functions start out as a “parent function”: $f(x) = x^2$, the simplest Quadratic Function. As the function becomes more complex, its graph starts to move through the coordinate plane.

Vertex Form Transformation “Zones”

$$f(x) = \pm a(x \pm h)^2 \pm k$$



List of Transformations

Vertical Shift: _____

Horizontal Shift: _____

Stretch & Compression: _____

Vertical Reflection: _____

Describe in words the transformation of the following Quadratic Functions.

$f(x) = x^2 - 5$ _____

$f(x) = x^2 + 5$ _____

$f(x) = (x + 5)^2$ _____

$f(x) = (x - 5)^2$ _____

$f(x) = 5x^2$ _____

$f(x) = 1/5x^2$ _____

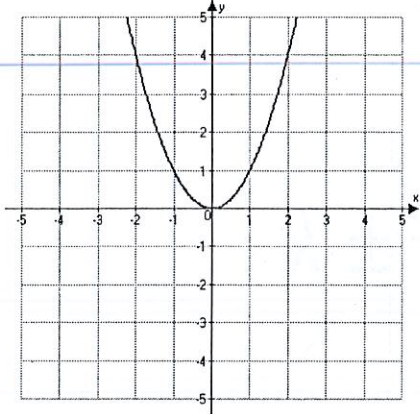
$f(x) = -x^2$ _____

Intermediate Algebra

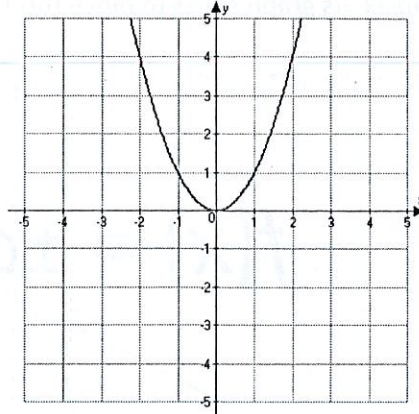
Unit 2 – Square Functions – Transformations of Quadratic Functions – Group Work

Using the graph of $f(x) = x^2$ as a guide, describe the transformations, and then graph each function.

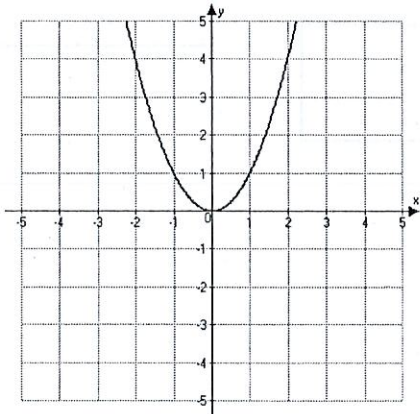
$$f(x) = x^2 + 2$$



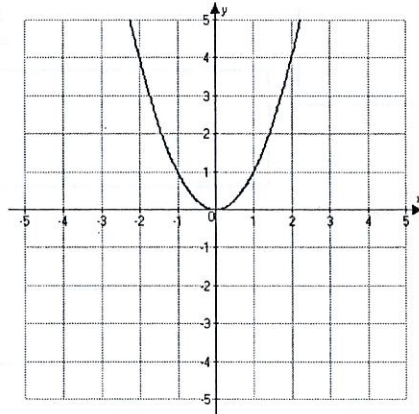
$$f(x) = x^2 - 2$$



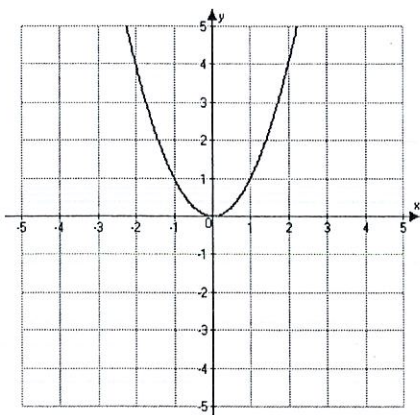
$$f(x) = 2x^2$$



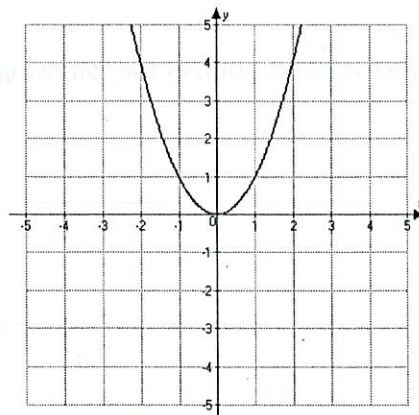
$$f(x) = \frac{1}{2}x^2$$



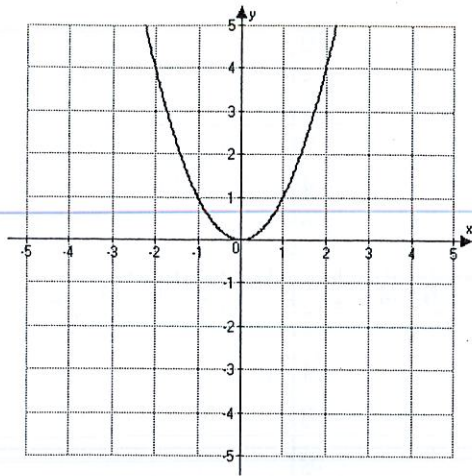
$$f(x) = (x - 2)^2$$



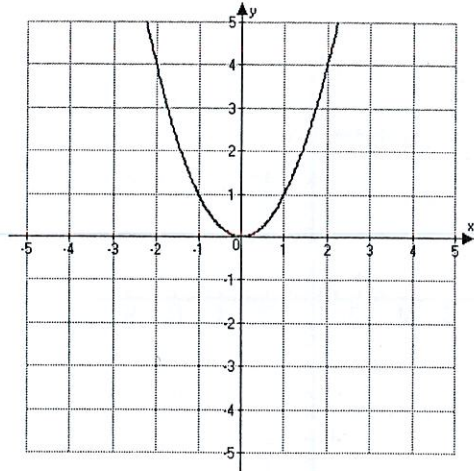
$$f(x) = (x + 2)^2$$



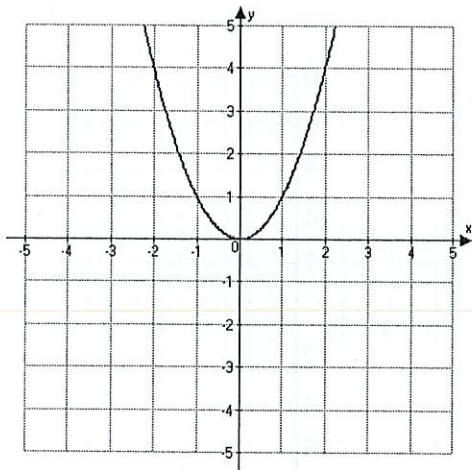
$$f(x) = (x - 1)^2 + 1$$



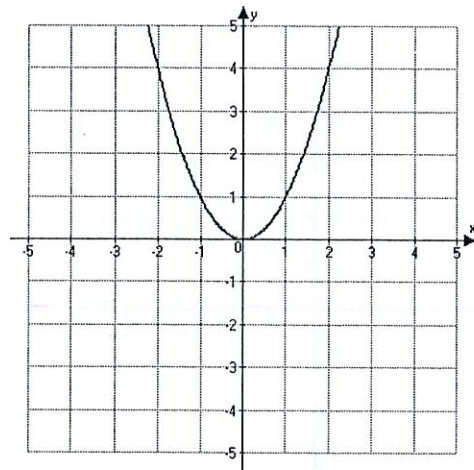
$$f(x) = (x - 1)^2 - 1$$



$$f(x) = 2(x - 2)^2$$

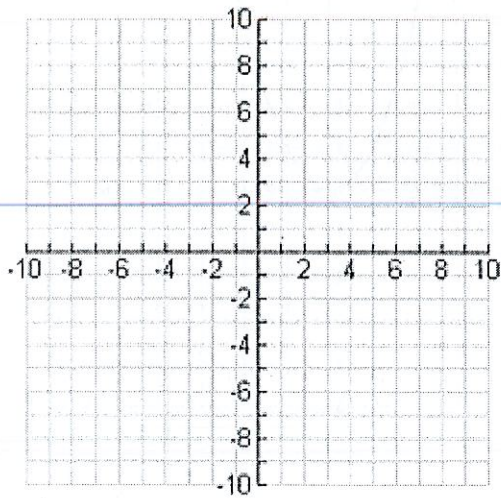


$$f(x) = -2(x + 1)^2 - 1$$

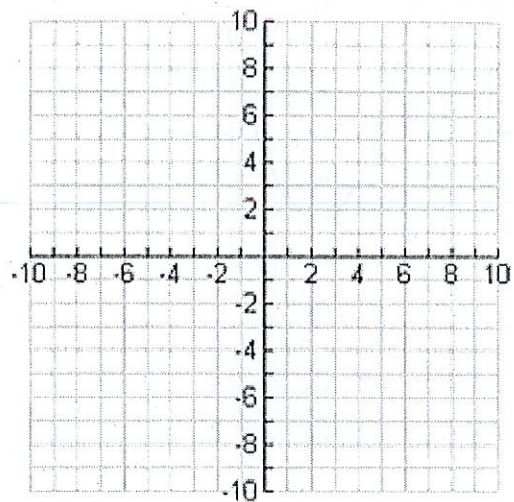


Graph the quadratic function. Describe the transformation from the parent function $f(x) = x^2$.

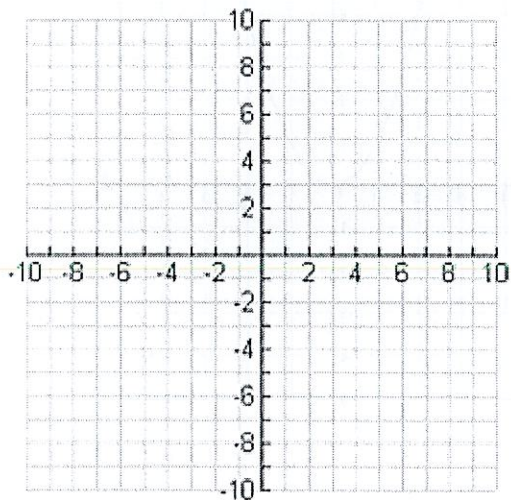
7. $f(x) = x^2 - 4$



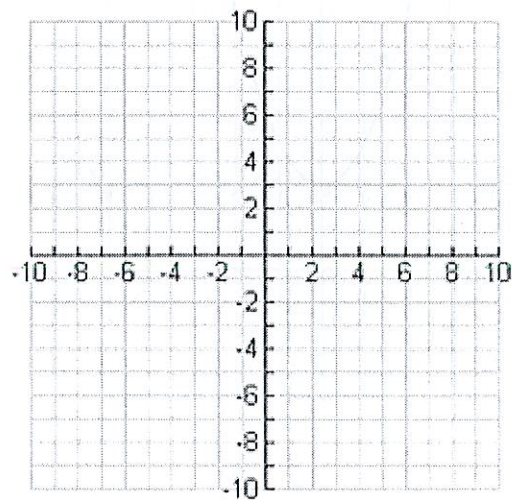
8. $f(x) = 2x^2 - 2$



9. $f(x) = -x^2 + 2$



10. $f(x) = (x - 1)^2 + 1$



An expression of the form $a^2 - b^2$ is defined as the **difference of two squares**. It also follows a pattern that makes it easy to factor.

Key Concepts

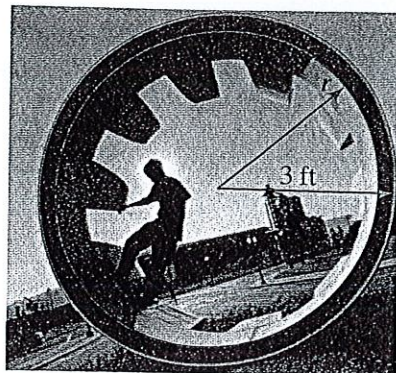
Property

Factoring a Difference of Two Squares

$$a^2 - b^2 = (a + b)(a - b)$$

8 EXAMPLE Real-World Connection

Hydraulics The photo at the right shows the cross-section of a pipe. Express the pipe's cross-sectional area in completely factored form.



Relate pipe's area equals the outer area minus the inner area

Define Let r = inner radius in feet.

Write

$$\begin{aligned} \text{area} &= \pi(3)^2 - \pi r^2 \\ \text{area} &= \pi(3)^2 - \pi r^2 \\ &= \pi(3^2 - r^2) \\ &= \pi(3 + r)(3 - r) \end{aligned}$$

The cross-sectional area of the pipe in factored form is $\pi(3 + r)(3 - r)$ ft².

Need Help?
For a circle, $A = \pi r^2$.

Check Understanding

Factor each expression.
a. $x^2 - 64$

b. $4a^2 - 49$

EXERCISES

For more practice, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Find the GCF of each expression. Then factor the expression.

Example 1
(page 255)

1. $3a^2 + 9$
4. $5t^2 + 7t$

2. $25b^2 - 35$
5. $14y^2 + 7y$

3. $x^2 - 2x$
6. $27p^2 - 9p$

Factor each expression.

Example 2
(page 256)

7. $x^2 + 3x + 2$
10. $x^2 + 10x + 16$

8. $x^2 + 5x + 6$
11. $y^2 + 15y + 36$

9. $x^2 + 7x + 10$
12. $x^2 + 22x + 40$

Example 3
(page 256)

13. $x^2 - 3x + 2$
16. $x^2 - 10x + 24$

14. $x^2 - 13x + 12$
17. $d^2 - 12d + 27$

15. $r^2 - 11r + 18$
18. $x^2 - 13x + 36$

Example 4
(page 257)

19. $x^2 - 5x - 14$
22. $c^2 + 2c - 63$

20. $x^2 + x - 20$
23. $x^2 + 10x - 75$

21. $x^2 - 3x - 40$
24. $t^2 - 7t - 44$

Example 5
(page 257)

25. $3x^2 + 31x + 36$
28. $2m^2 - 11m + 15$

26. $2x^2 - 19x + 24$
29. $5t^2 + 28t + 32$

27. $5r^2 + 23r + 26$
30. $2x^2 - 27x + 36$