

Introduction to Quadratic Functions

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PRE-CALCULUS 11 QUADRATIC FUNCTIONS INTRODUCTION TO THE QUADRATIC FUNCTION

A. Definitions

1. **quadratic equation:** an equation that can be written in the form: $ax^2 + bx + c = 0$.
Where a, b and c are constants and $a \neq 0$.
2. **quadratic function:** any function that can be written in the form:
 $y = ax^2 + bx + c$ or $f(x) = ax^2 + bx + c$. Where a, b and c are constants and $a \neq 0$.
3. **x-intercept:** the place where the shape crosses the x-axis. These are also referred to as the roots or zeros of the function.
4. **y-intercept:** the place where the shape crosses the y-axis. In the form of the quadratic function the c value represents the y-intercept.

B. Recognizing Quadratic Functions

Remember that a Quadratic Function must be able to be written in the form
 $y = ax^2 + bx + c$ or $f(x) = ax^2 + bx + c$.

Quadratic Functions

$$y = 2x^2 - 7x - 3$$

$$f(x) = (x - 5)(x + 7)$$

$$y = x^2$$

$$y = -0.8x^2 - \sqrt{3}$$

Not Quadratic Functions

$$y = x^3 + 3x^2 - 5x$$

$$g(x) = \sqrt{x} - 5$$

$$y = \frac{1}{x^2 + 3x + 2}$$

$$p(x) = -4x + 5$$

$$\boxed{X^3}$$

$$\boxed{X^{\frac{1}{2}}}$$

$$\boxed{X^{-2}}$$

$$\boxed{X^1}$$

C. Important Information in a Quadratic Function

Since a quadratic function is the graphical form of a quadratic equation it should make sense that many of the skills used in the previous unit on Solving Quadratic Equations will continue to be used in this unit. The x-intercepts are found by finding the roots of the equation. The y-intercept is found by using zero substitution or by finding the c value in the equation.

1) Determine the x-intercept and y-intercept for each quadratic function.

a) $y = (x+3)(x-4)$

$$0 = (x+3)(x-4)$$

$$0 = x + 3 \quad 0 = x - 4$$

$$\boxed{\text{X-int } (-3, 0) \ \& \ (4, 0)}$$

$$y = (0+3)(0-4)$$

$$y = (3)(-4)$$

$$\boxed{\text{y-int } (0, -12)}$$

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

$$0 = (2x+1)(2x+1)$$

$$0 = 2x + 1 \quad 0 = 2x + 1$$

$$-\frac{1}{2} = \frac{1}{2}x \quad -\frac{1}{2} = \frac{1}{2}x$$

$$\boxed{\text{X-int } \left(-\frac{1}{2}, 0\right)}$$

$$y = (2(0)+1)^2$$

$$y = (1)^2$$

$$\boxed{\text{y-int } (0, 1)}$$

$$\begin{array}{r} 21 \\ \times (-7) \quad (-3) \\ \hline -10 \end{array}$$

c) $y = 2x^2 - 20x + 42$

$$0 = 2x^2 - 20x + 42$$

$$0 = 2(x^2 - 10x + 21)$$

$$0 = 2(x-7)(x-3)$$

$$0 = x - 7 \quad 0 = x - 3$$

$$\boxed{\text{X-int } (7, 0) \ \& \ (3, 0)}$$

$$\boxed{\text{y-int } (0, 42)}$$

$$\begin{array}{r} -6 \\ \times (6) \quad (-1) \\ \hline 5 \end{array}$$

d) $y = 3x^2 + 5x - 2$

$$0 = 3x^2 + 5x - 2$$

$$0 = \left(x + \frac{6}{2}\right)\left(x - \frac{1}{2}\right)$$

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

$$0 = x + 3 \quad 0 = 2x - 1$$

$$\boxed{\text{X-int } (-3, 0) \ \& \ \left(\frac{1}{2}, 0\right)}$$

$$\boxed{\text{y-int } (0, -2)}$$

If the quadratic function is not easily factorable, we can still find the x-intercepts (zeros) by either using the completing the square method, or by the quadratic formula.

- 2) Determine the x-intercepts of the following quadratic function. Round your answer to the nearest hundredth.

$$y = 2x^2 - 5x + 1$$

$$a = 2, b = -5, c = 1$$

$$x = \frac{5 + \sqrt{17}}{4}, \quad x = \frac{5 - \sqrt{17}}{4}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(1)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{17}}{4}$$

$$\text{x-int } (2.28, 0) \text{ \& } (0.22, 0)$$

Remember that the General Form of a quadratic function is $y = ax^2 + bx + c$. If an equation is not presented in this form we can alter the form using simple algebra.

- 3) Write the equation of the quadratic function in General Form. Then determine the values of a, b and c .

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

$$y = (-2x - 6)(x - 1)$$

$$y = -2x^2 + 2x - 6x + 6$$

$$y = -2x^2 - 4x + 6$$

$$a = -2, b = -4, c = 6$$

Assignment : Quadratic Functions Assignment #1 - 20

PRE-CALCULUS 11
QUADRATIC FUNCTIONS
QUADRATIC FUNCTIONS ASSIGNMENT

A. Determine the zeros for the following quadratic functions.

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

2) $y = (4x + 3)(2x + 3)$

3) $f(x) = x^2 - 7x + 10$

4) $y = x^2 + 10x + 25$

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

6) $h(x) = 4x^2 + 12x + 9$

B. Determine the roots for the following quadratic functions. Round your answer to the nearest hundredth.

7) $y = x^2 - 4x - 6$

8) $f(x) = x^2 + 3x + 6$

9) $y = 2x^2 - 8x + 2$

10) $y = -\frac{1}{2}x^2 + 3x + 5$

C. Determine the y-intercept for the following quadratic functions.

11) $y = x^2 - 7x + 3$

12) $g(x) = 2x^2 - 8$

13) $h(x) = (x + 4)(x - 3)$

14) $y = 2x(x - 7)$

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

16) $p(x) = \frac{1}{2}(x + 3)(x - 5)$

D. Write the equation of the quadratic function in General Form. Then determine the values of a, b and c.

17) $y = (x - 5)(x + 5)$

18) $f(x) = 3(x + 1)(x - 4)$

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

20) $y = 2x(x - 9)$

Answers

1) $-3, 2$

2) $-\frac{3}{4}, -\frac{3}{2}$

3) $2, 5$

4) -5

5) $-1, \frac{4}{3}$

6) $-\frac{3}{2}$

7) $-1.16, 5.16$

8) No Real Roots

9) $0.27, 3.73$

10) $-1.36, 7.36$

11) y-int = $(0,3)$

12) y-int = $(0,-8)$

13) y-int = $(0,-12)$

14) y-int = $(0,0)$

15) y-int = $(0,-4)$

16) y-int = $\left(0, -\frac{15}{2}\right)$

17) $y = x^2 - 25$
 $a = 1, b = 0, c = -25$

18) $f(x) = 3x^2 - 9x - 12$
 $a = 3, b = -9, c = -12$

19) $y = -\frac{1}{3}x^2 - 2x - \frac{8}{3}$
 $a = -\frac{1}{3}, b = -2, c = -\frac{8}{3}$

20) $y = 2x^2 - 18x$
 $a = 2, b = -18, c = 0$