

The Quadratic Formula

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PRE-CALCULUS 11 QUADRATIC EQUATIONS THE QUADRATIC FORMULA

A. Definitions

- quadratic formula:** a formula used to determine the solution(s) to a quadratic equation. The solution of a quadratic equation in the form $ax^2 + bx + c = 0$, where a, b and c are constants and $a \neq 0$, is given by the formula:

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

- roots/zeros:** the answer(s) to a quadratic equation.

B. Solving Quadratic Equations Using the Quadratic Formula

- Solve the following quadratic equations (as exact values).

a) $x^2 + 4x - 1 = 0$
 $a = 1, b = 4, c = -1$

$$\begin{aligned} X &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(4) \pm \sqrt{(4)^2 - 4(1)(-1)}}{2(1)} \\ &= \frac{-4 \pm \sqrt{20}}{2} \quad \sqrt{4 \cdot 5} = \frac{-4 \pm 2\sqrt{5}}{2} = \boxed{-2 \pm \sqrt{5}} \end{aligned}$$

b) $x^2 - x + 4 = 0$
 $a = 1, b = -1, c = 4$

$$\begin{aligned} X &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(4)}}{2(1)} \\ &= \frac{1 \pm \sqrt{-15}}{2} \end{aligned}$$

square root of negative (unsolvable).

No Solution.

- 2) Find the roots of the following quadratic equation. Give your answer as an exact value in simplest form and to the nearest hundredth.

$$4x^2 = 3(4x + 5)$$

$$4x^2 = 12x + 15$$

$-12x$ $-12x$ -15
 -15

$$4x^2 - 12x - 15 = 0$$

$$a = 4, b = -12, c = -15$$

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

$$= \frac{-(-12) \pm \sqrt{(-12)^2 - 4(4)(-15)}}{2(4)}$$

$$= \frac{12 \pm \sqrt{384}}{8}$$

$\sqrt{64} \cdot \sqrt{6}$

$$= \frac{(2 \pm 8)\sqrt{6}}{8}$$

$$= \frac{3 \pm 2\sqrt{6}}{2}$$

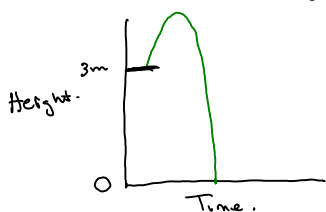
$$x = \frac{3 + 2\sqrt{6}}{2} \quad x = \frac{3 - 2\sqrt{6}}{2}$$

$$= 3.949... \quad = -0.949$$

$$X = 3.95 \quad x = -0.95$$

- 3) An Olympic diver diving off a 3 m springboard is defined by the formula

$h = -4.9t^2 + 8.8t + 3$, where h represents the height in metres and t represents the time in seconds after leaving the board. How long does it take a diver to reach the water? Round your answer to nearest tenth.



$$h = -4.9t^2 + 8.8t + 3$$

$$0 = -4.9t^2 + 8.8t + 3$$

$$a = -4.9, b = 8.8, c = 3$$

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

$$= \frac{-(8.8) \pm \sqrt{(8.8)^2 - 4(-4.9)(3)}}{2(-4.9)}$$

$$= \frac{-8.8 \pm \sqrt{136.24}}{-9.8}$$

$$X = \frac{-8.8 + \sqrt{136.24}}{-9.8}$$

$$X = \frac{-8.8 - \sqrt{136.24}}{-9.8}$$

$$X = -0.293...$$

$$X = 2.088...$$

Can't have negative time.

$$X = 2.1 \text{ seconds}$$

Assignment:

The Quadratic Formula Assignment #1 - 8

Assignment

1. Solve the equation $x^2 - 3x - 10 = 0$ by using;
 - a) inspection
 - b) the quadratic formula

2. Solve the equation $4x^2 - 11x - 3 = 0$ by using;
 - a) decomposition
 - b) the quadratic formula

3. Find the exact roots of the equation $6x^2 + 5x + 1 = 0$ by using;
 - a) graphing
 - b) the quadratic formula

4. Find the roots of the following quadratic equations (to the nearest tenth) using the quadratic formula.

a) $2x^2 + x - 4 = 0$

b) $2x^2 - 3x - 4 = 0$

c) $10t^2 = 7t + 1$

5. Solve the following quadratic equations (as exact values) using the quadratic formula.

a) $x^2 - 10x - 15 = 0$

b) $x^2 + 6x + 7 = 0$

c) $3x^2 - 12x + 11 = 0$

6. Find the zeros of the following quadratic functions
Give answers as exact values in simplest form and to the nearest hundredth.

a) $f(x) = x^2 + 20x + 15$

b) $f(x) = 5x^2 + 12x - 5$

Multiple Choice

7. The roots of the quadratic equation $dx^2 + ex + f = 0$ are

A. $x = \frac{e \pm \sqrt{e^2 - 4df}}{2d}$

B. $x = \frac{-e \pm \sqrt{e^2 - 4df}}{2d}$

C. $x = \frac{e \pm \sqrt{e^2 + 4df}}{2d}$

D. $x = \frac{-e \pm \sqrt{e^2 + 4df}}{2d}$

8. The zeros of the quadratic function $f(x) = 6x^2 + 2x - 1$ are

A. $\frac{-1 \pm \sqrt{14}}{6}$

B. $\frac{-1 \pm 2\sqrt{7}}{6}$

C. $\frac{-1 \pm \sqrt{7}}{6}$

D. $\frac{-2 \pm \sqrt{7}}{6}$

Numerical Response

9. The quadratic equation $2x^2 + 15x + p = 0$ has a positive root of $-\frac{1}{2}$ when p has the whole number value of _____.

(Record your answer in the numerical response box from left to right)

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Answer Key

1. a) -2, 5

b) -2, 5

2. a) $-\frac{1}{4}, 3$

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

3. a) $-\frac{1}{3}, -\frac{1}{2}$

b) $-\frac{1}{3}, -\frac{1}{2}$

4. a) -1.7, 1.2

b) -0.9, 2.4

c) -0.1, 0.8

5. a) $5 \pm 2\sqrt{10}$

b) $-3 \pm \sqrt{2}$

c) $\frac{6 \pm \sqrt{3}}{3}$

6. a) $-10 \pm \sqrt{85}$

-0.78, -19.22

b) $\frac{-6 \pm \sqrt{61}}{5}$ -2.76, 0.36

7. B

8. C

9.

7			
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