

4.4 The Quadratic Formula

The Quadratic Formula is a formula for determining the solutions of a quadratic equation of

the form $ax^2 + bx + c = 0$, $a \neq 0$.

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

The **DISCRIMINANT** is the expression $b^2 - 4ac$ located under the radical sign in the quadratic formula.

Use the value of the **discriminant** to determine the **NATURE** of the **ROOTS** for a quadratic equation:

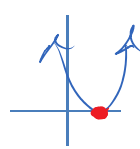
if the discriminant is **POSITIVE**, there are

2 real roots



if the discriminant is **ZERO**, there is

1 real root



if the discriminant is **NEGATIVE**, there is

0 real roots



Doesn't cross x-axis

Use the discriminant to determine the nature of the roots:

$$0 = 2x^2 - 3x - 8$$

$a = 2$ $b = -3$ $c = -8$
 $(-3)^2 - 4(2)(-8)$
 $= 9 + 64$
 $= 73$
 positive \rightarrow 2 roots

a b c
 $0 = \frac{1}{4}x^2 - 3x + 9$
 $(-3)^2 - 4(\frac{1}{4})(9)$
 $= 9 - 9$
 $= 0$
 zero \rightarrow 1 root

$$3x^2 - 5x = -9$$

$+9$ $+9$
 $3x^2 - 5x + 9 = 0$
 $a = 3$ $b = -5$ $c = 9$
 $(-5)^2 - 4(3)(9)$
 $= 25 - 108$
 $= -83$
 negative \rightarrow no roots

Use the **quadratic formula** to solve the quadratic equations:

(exact roots and approximate roots rounded to the nearest hundredth)

$$9x^2 + 12x = -4$$

$+4$ $+4$
 $9x^2 + 12x + 4 = 0$
 $a = 9$ $b = 12$ $c = 4$
 $x = \frac{-12 \pm \sqrt{(12)^2 - 4(9)(4)}}{2(9)}$
 $= \frac{-12 \pm 0}{18}$
 $x = -\frac{2}{3}$

$$5x^2 - 7x - 1 = 0$$

a b c
 $x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(5)(-1)}}{2(5)}$
 $x = \frac{7 \pm \sqrt{69}}{10}$ or
 $x = 1.53$ and -0.13

You know 4 strategies to solve quadratic equations:

- By *aphing*
- By *Factoring*
- By *CTS & square rooting*
- Using the *Quadratic formula!*

Solve using any method:

$$6x^2 - 14x + 8 = 0$$

$$x = \frac{-(-14) \pm \sqrt{(-14)^2 - 4(6)(8)}}{2(6)}$$

$$x = \frac{14 \pm 2}{12}$$

$$= \frac{14+2}{12} = \frac{16}{12} = \frac{4}{3}$$

$$= \frac{14-2}{12} = \frac{12}{12} = 1$$

$$x = \frac{4}{3} \text{ and } 1$$

$$2x^2 - 7x + 4 = 0$$

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(4)}}{2(2)}$$

$$= \frac{7 \pm \sqrt{17}}{4}$$

$$= \frac{7 + \sqrt{17}}{4} \approx 2.78$$

$$= \frac{7 - \sqrt{17}}{4} \approx 0.72$$

$$x = 2.78 \text{ and } 0.72$$

$$2(1.5x^2 - 9x + 1.5 = 0)$$

(exact roots)

$$3x^2 - 18x + 3 = 0$$

$$x = \frac{-(-18) \pm \sqrt{(-18)^2 - 4(3)(3)}}{2(3)}$$

$$= \frac{18 \pm \sqrt{288}}{6}$$

$$= \frac{18 \pm \sqrt{144 \cdot 2}}{6}$$

$$= \frac{18 \pm 12\sqrt{2}}{6}$$

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

Leah wants to frame a painting measuring 50 cm by 60 cm. Before framing, she places the painting on a rectangular MAT so that a uniform strip of the MAT is shown on all sides of the painting. The area of the MAT is twice the area of the painting. How wide is the strip of exposed MAT showing on all sides of the painting, to the nearest tenth?

do tomorrow!

3ace