

4.4 The Quadratic Formula

from #15 in 4.3: for any quadratic $ax^2 + bx + c = 0$

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

$b^2 - 4ac$ is called the discriminant

if $b^2 - 4ac > 0$: 2 distinct real roots

if $b^2 - 4ac = 0$: 1 real root (1 double root / 1 equal root)

if $b^2 - 4ac < 0$: 0 real roots

ex 1 Solve $-2x^2 + 3x + 8 = 0$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(-2)(8)}}{2(-2)}$$

$$x = \frac{-3 \pm \sqrt{9 + 64}}{-4}$$

$$x = \frac{-3 \pm \sqrt{73}}{-4}$$

$$x = \frac{3 \pm \sqrt{73}}{4}$$

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

$$3x^2 - 5x - 9 = 0$$

$0 = -3x^2 + 5x + 9$

$$x = \frac{5 \pm \sqrt{25 - 4(3)(-9)}}{6}$$

$$x = \frac{5 \pm \sqrt{25 + 108}}{6}$$

$$x = \frac{5 \pm \sqrt{133}}{6}$$

ex 3 Solve $\frac{1}{4}x^2 - 3x + 9 = 0$

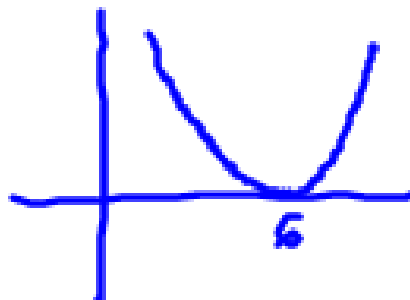
or $x^2 - 12x + 36 = 0$

$$x = \frac{12 \pm \sqrt{144 - 4(1)(36)}}{2}$$

$$x = \frac{12 \pm \sqrt{144 - 144}}{2}$$

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

$$x = 6$$



ex 4 Solve $9x^2 + 12x = -4$
to 2 decimal places

$$9x^2 + 12x + 4 = 0$$

$$x = \frac{-12 \pm \sqrt{144 - 4(9)(4)}}{18}$$

$$x = -\frac{12}{18}$$

$$x = -\frac{2}{3}$$

$$x \approx 0.67$$

ex 5 Solve $5x^2 - 7x - 1 = 0$ to the nearest hundredth.

$$x = \frac{7 \pm \sqrt{49 - 4(5)(-1)}}{10}$$

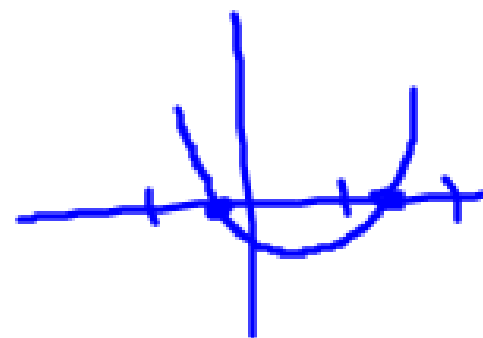
$$x = \frac{7 \pm \sqrt{69}}{10}$$

$$(7 + \sqrt{69}) / 10$$

$$x = 1.53$$

$$(7 - \sqrt{69}) / 10$$

$$x = -0.13$$



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

- a) graphically / technology
- b) factoring
- c) completing the square
- d) quad formula

a) $y_1 = 6x^2 - 14x + 8$
 $y_2 = 0$
calc intersect
✓ $(1, 0)$ $(1.33, 0)$
 $x = 1$ $x = 1.33$

OR
✓ $y_1 = 6x^2 - 14x + 8$
calc zeroes
 $x = 1$ $x = 1.33$



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

$3x^2 - 7x + 4 = 0$
prod 12
sum -7
-4, -3

$3x^2 - 3x - 4x + 4 = 0$

$3x(x-1) - 4(x-1) = 0$

$(x-1)(3x-4) = 0$

$x-1=0$ $3x-4=0$

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

c) $6x^2 - 14x = -8$

$x^2 - \frac{14}{6}x = -\frac{8}{6}$

* $x^2 - \frac{7}{3}x = -\frac{4}{3}$

* $x^2 - \frac{7}{3}x + \frac{49}{36} = -\frac{4}{3} + \frac{49}{36}$

* $(x - \frac{7}{6})^2 = \frac{1}{36}$

* $\left[\begin{array}{l} x - \frac{7}{6} = \pm \frac{1}{6} \\ x = \frac{7}{6} \pm \frac{1}{6} \end{array} \right.$

$x = \frac{8}{6}$ $x = \frac{6}{6}$

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

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

$$3x^2 - 7x + 4 = 0$$

$$x = \frac{7 \pm \sqrt{49 - 4(3)4}}{6}$$

$$x = \frac{7 \pm \sqrt{1}}{6}$$

$$x = \frac{7 \pm 1}{6}$$

$$x = \frac{8}{6}, \frac{6}{6}$$

$$x = \frac{4}{3}, 1$$

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