Present Monday: #4, 9, and 10 from the .pdf file on my wwwsite.

9:55 Nicole Nie., Rachel, Hannah, Chelsea, Molly, Amy Sur.
11:00 Erin San., Jamie, Victoria, Abbey, Kelly, Jeffrey Ste.

Factor using the common factor quotient method.

4. $4x^3 - 12x^2 - 7x$

Complete the square and solve using the square root method.

9. $x^2 - 9x = -18$
10. $x^2 - 6x + 4 = 0$

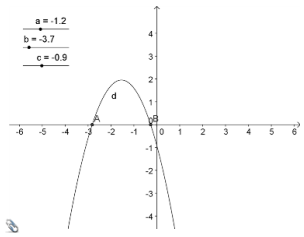
Homework: Sec. 7.7 #3, 4, 11, 13, 14, 15, 23, 25, 27, 29, 39, 43, 45, 47

Present Tuesday: 7.7 #14, 27, [43&45]

9:55 Jared Taf., Briana, Rachel, Jena, Rebekah Wol., Luke Ack.
11:00 Kayla Tet., Kelly, Calli, Molly, Tyson You., Colin Abe.

Solving Quadratic Equations

$ax^2 + bx + c = 0$



Three methods:

1. Factor and use ZPP.
2. Complete the square.
3. Apply the quadratic formula.

Solving Quadratic Equations: Complete the Square

Solve by completing the square and using the square root principle:

B) $2x^2 - x - 1 = 0$

requires $a = 1$ $(ax^2 + bx + c = 0)$

$\Rightarrow x^2 - \frac{1}{2}x - \frac{1}{2} = 0$

$\left(-\frac{1}{4}\right)^2 = \frac{1}{16}$, $+\frac{1}{2}$, $+\frac{1}{16}$

$\Rightarrow x^2 - \frac{1}{2}x + \frac{1}{16} = \frac{1}{2} + \frac{1}{16} = \frac{8}{16} + \frac{1}{16}$

$\Rightarrow \left(x - \frac{1}{4}\right)^2 = \frac{9}{16}$

$\sqrt{\frac{9}{16}} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}$

$\Rightarrow x - \frac{1}{4} = \pm\frac{3}{4}$

$\Rightarrow x = \frac{1}{4} + \frac{3}{4}$ or $\frac{1}{4} - \frac{3}{4}$

$\Rightarrow x = 1$ or $-\frac{1}{2}$

Solving Quadratic Equations: Factoring and ZPP

The ZPP (zero product principle) states:
If $ab = 0$, then either $a = 0$ or $b = 0$.

Solve by factoring:

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

$(x - 5)(x + 3) = 0$

$\Rightarrow x - 5 = 0$ OR $x + 3 = 0$

$\Rightarrow x = 5$ OR $x = -3$

$\Rightarrow x \in \{-3, 5\}$

Solving Quadratic Equations: Factoring and ZPP

The ZPP (zero product principle) states:
If ab = 0, then either a = 0 or b = 0.

Solve: $(x+3)(x-2) = -4$

$x+3 = -4$ OR $x-2 = -4$

↳ INCORRECT!

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

$\Rightarrow x^2 + x - 2 = 0$

$\Rightarrow (x+2)(x-1) = 0$

$x+2=0$ or $x-1=0$

$x=-2$ or $x=1$

$x \in \{-2, 1\}$

Solving Quadratic Equations: The Quadratic Formula

If $ax^2 + bx + c = 0$, then the two solutions are:

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

Use the quadratic formula to solve. Simplify your answer.

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

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

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

$$= \frac{1 \pm \sqrt{1-(-8)}}{4}$$

$$= \frac{1 \pm \sqrt{9}}{4} = \frac{1 \pm 3}{4}$$

$x = \frac{1+3}{4} = 1$ or $x = \frac{1-3}{4} = -\frac{1}{2}$

Solve via the quadratic formula. Compare with the method you used in your homework last time.

9. $x^2 - 9x = -18$
10. $x^2 - 6x + 4 = 0$

10) $a = 1$, $b = -6$, $c = 4$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(4)}}{2(1)}$$

$$= \frac{6 \pm \sqrt{36-16}}{2(1)}$$

$$= \frac{6 \pm \sqrt{20}}{2}$$

$\sqrt{a \cdot b} = \sqrt{a}\sqrt{b}$

$$= \frac{6 \pm \sqrt{5 \cdot 4}}{2}$$

$$= \frac{6 \pm \sqrt{5} \cdot 2}{2}$$

$$= \frac{2(3 \pm \sqrt{5})}{2}$$

$$= 3 \pm \sqrt{5}$$

The Discriminant

We can use the discriminant $b^2 - 4ac$ to determine the types of solutions we can expect when solving a quadratic equation.

Complete the table below:

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

Two distinct *rational* solutions.

Descriminant	Solutions
$b^2 - 4ac > 0$	Two distinct solutions (irrational)
$b^2 - 4ac > 0$ *and* a perfect square	Two distinct *rational* solutions **(the quadratic is factorable!)**.
$b^2 - 4ac = 0$	One (repeated) *rational* solution.
$b^2 - 4ac < 0$	No real solutions.

Check the discriminant for the following quadratic equations. What can you conclude about the solutions?

9. $x^2 - 9x = -18$ → $x^2 - 9x + 18 = 0$
10. $x^2 - 6x + 4 = 0$

10) $b^2 - 4ac = (-6)^2 - 4(1)(4) = 20$

9) $b^2 - 4ac = (-9)^2 - 4(1)(18) = 81 - 72 = 9$

Using the Discriminant

Calculate the discriminant to determine whether the following can be solved by factoring.

$5x^2 + 10x + 6 = 0$

$b^2 - 4ac = 10^2 - 120 = -20$

no solutions!

$3x^2 + 2x - 6 = 0$

$b^2 - 4ac = 4 - 4(3)(6) = 76$

76 is not a perfect square → not factorable

Using the Discriminant

2. Given the quadratic equation $-2x^2 + bx + 8$. Is it possible to find b so that the quadratic equation has:

✓a) two rational solutions,
✓b) two real (non-rational) solutions,
×c) one real solution,
×d) no real solutions?

-16 1

$b = -15$?

} no, $b^2 + 64 \geq 64 > 0$

For each of the above, **find one such b (if possible)** OR explain **why it is not** possible.

a) $b^2 - 4ac = b^2 - 4(-2)(8)$

$= b^2 + 64 \stackrel{?}{=} 0$

Can you choose b so that $b^2 - 64$ is a perfect square?

yes: $b = 0$, $b = \pm 6$, $b = \pm 15$?

In Closing, An Application

Kim is flying a kite that is 30 feet farther above her hand than its horizontal distance from her. The string from her hand to the kite is 150 feet long. How far is the kite above her hand?