1.6 Solve Quadratic Equations

Recall: Solving a quadratic equation means finding the value of the roots, zeros or x-intercepts. You are finding where the function, f(x) is zero.

A. Solve by Factoring

How do you find zeros?
1. Set f(x) = 0.
2. Factor.
3. Set each factor = 0 and solve for x.

Ex. 1 Solve each of the following:

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

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

$x-3=0$

$x=3$

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

b) $f(x)=x^2+7x-30$

$=(x+10)(x-3)$

$x=-10$ $\quad$ $x=3$

c) $f(x)=4x^2-9$

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

$2x+3=0$

$2x=-3$

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

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

d) $f(x)=3x^2+12x$

$=3x(x+4)$

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

e) Find the vertex of d)

axis

$x=\frac{0+(-4)}{2}$

$=-2$

$f(-2)=3(-2)(-2+4)$

$=-6(2)$

$=-12$

$\therefore$ Vertex$(-2,-12)$

B. Solve from Vertex Form

1. Set y = 0.
2. Isolate for x

Ex. 1 Solve each of the following:

$0\ \cancel{f(x)}=2(x-3)^2-8$

$8=2(x-3)^2$

$4=(x-3)^2$

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

$3\pm2=x$

$x=3+2$

$=5$

$x=3-2$

$=1$

C. Solve using the Quadratic Formula

Exact answers only!!!

Requires Std form: ax^2+bx+c

Recall:

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

Ex. 1 Solve. Give exact answers only.

$a=3 \quad b=4 \quad c=-2$

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

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

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

$$=\frac{-4\pm\sqrt{16+24}}{6}$$

$$=\frac{-4\pm\sqrt{40}}{6}$$

$$\rightarrow=\frac{-\overset{2}{\cancel{4}}\pm\overset{1}{\cancel{2}}\sqrt{10}}{\underset{3}{\cancel{6}}}$$

$$=\frac{-2\pm\sqrt{10}}{3}$$

$a=5 \quad b=-3 \quad c=2$

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

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

$$=\frac{3\pm\sqrt{(-3)^2-4(5)(2)}}{2(5)}$$

$$=\frac{3\pm\sqrt{-31}}{10}$$

∴ No sol^n

∴ No zeros

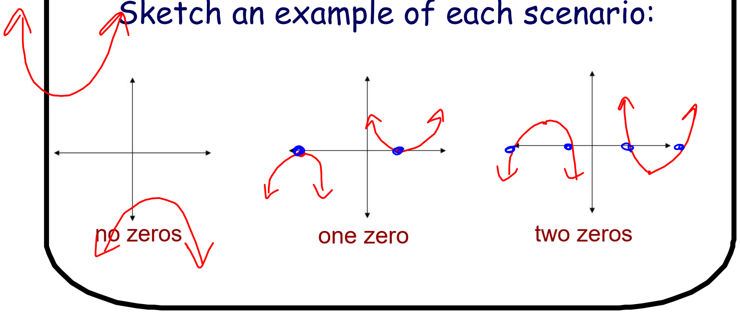
We can determine the number of roots by looking under the radical sign

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

This is known as the **Discriminant** $\boxed{b^2-4ac}$

Quadratics can have no zeros, 1 zero, or 2 zeros.

Sketch an example of each scenario:



- If $b^2-4ac>0$ then there is two real roots
- If $b^2-4ac=0$ then there is one real root
- If $b^2-4ac<0$ then there is no real roots

Ex. 2 For each quadratic equation, determine the number of roots.

a) $2x^2 - x + 5 = 0$

$D = b^2 - 4ac$

$= (-1)^2 - 4(2)(5)$

$= 1 - 40$

$= -39$

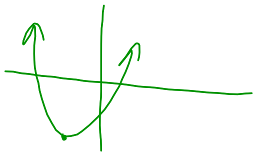
$D < 0$

∴ No roots

b) $4(x + 1)^2 - 7 = 0$

$V(-1, -7)$

Opens UP!



∴ 2 zeroes

c) $(x - 6)^2 = 0$

$v(6, 0)$ (on the axis!)

∴ One zero

d) $2x^2 + 8x + 8 = 0$

$D = b^2 - 4ac$

$= 8^2 - 4(2)(8)$

$= 64 - 64$

$= 0$

∴ One zero

Homework
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