2.11 The Discriminant

Solve each of the following equations using the Quadratic formula:

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

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

$= \frac{4 \pm \sqrt{16-8}}{4}$

$= \frac{4 \pm \sqrt{8}}{4}$ # > 0

$\therefore$ 2 sol^{ns}

b) $x^2 + 2x + 1 = 0$

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

$= \frac{-2 \pm \sqrt{0}}{2}$ # = 0

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

$\therefore$ 1 sol^{n}

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

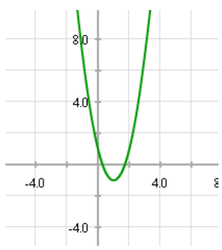
$x = \frac{3 \pm \sqrt{(-3)^2 - 4(2)(3)}}{2(2)}$

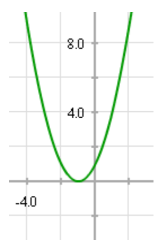
$= \frac{3 \pm \sqrt{9-24}}{4}$

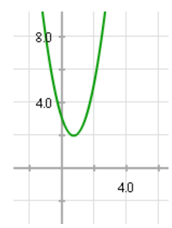
$= \frac{3 \pm \sqrt{-15}}{4}$ # < 0

$\therefore$ 0 sol^{ns}

Picture it:







What do you notice about the number of roots?

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

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

This is know as the Discriminant $b^2 - 4ac$

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 1: Determine the number of real solutions:

a) $2x^2 - x + 5 = 0$ std form use D

$D = b^2 - 4ac$

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

$= -39$

$D < 0$ $\therefore$ no real roots

b) $4(x+1)^2 - 7 = 0$ vertex form opens up vertex below axis $\therefore$ two roots

c) $(x-6)^2 = 0$ perfect sq vertex on the axis $\therefore$ one root

d) $(x-3)(x+2) = 0$ Factored $\therefore$ two real roots

Ex 2:

For what values of k does $f(x) = \overset{a}{x^2} + \overset{b}{kx} + \overset{c}{9}$ have 2 distinct real solutions?

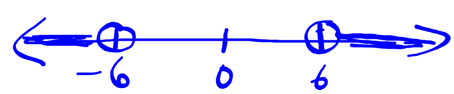
$D > 0$

$k^2 - 4(1)(9) > 0$

$k^2 - 36 > 0$

$k^2 > 36$

Think



then

$k > 6$ OR $k < -6$

Ex 3: State the # of zeros

a) $5 = 4x^2 - 12x + 14$

Rearrange

$0 = 4x^2 - 12x + 9$ ← notice Perfect Square

∴ one real root

or

$D = (12)^2 - 4(4)(9)$
$= 0$

b) $3(x + 2)^2 = 7x$

$3(x+2)^2 - 7x = 0$

not factored
Not vertex
expand to std form

$3(x+2)(x+2) - 7x = 0$

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

$3x^2 + 12x + 12 - 7x = 0$

$3x^2 + 5x + 12 = 0$

Then

$D = (5)^2 - 4(3)(12)$
$= -119$

$D < 0$ ∴ no real roots

Ex 3:

Given the quadratic equation:

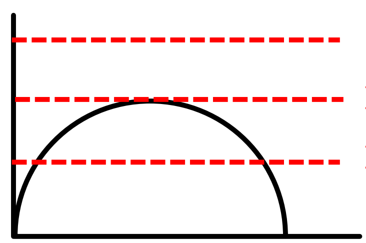
$$f(x) = -0.011x^2 + x + 1.6$$

Can $f(x) = 15$?

want a yes or no answer
sub in 15 then look at the
Discriminant

Picture it

Where is $f(x)=15$?



15m ? then no

15m ? then yes

15m ? then yes

$$15 = -0.011x^2 + x + 1.6$$

$$0 = -0.011x^2 + x - 13.4$$

then

$$D = (1)^2 - 4(-0.011)(-13.4)$$

$$= 0.4104$$

$D > 0$ ∴ yes $f(x)$ can $= 15$ for two values of x

1. Quiz
2. Hmwk:

p 232 # 2, 1d, 4 - 7, 14*, 15*