1. Complete the square for the quadratic relation $y = 0.2b^2 - 10b + 650$.

2. Solve. Express answers as exact values.

a) $2x^2 - 8x = 0$ b) $4(2x - 1)^2 = 36$ c) $5x^2 - 6x - 2 = 0$

5.6 Quadratic Formula Problems

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Q
U
IV
A
L
E
N
T

zero
root
solution
x-intercept

Last class we saw...

Ex.2 Solve each of the following using the quadratic formula.

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

$$x = \frac{5 \pm \sqrt{25 - 4(2)(-1)}}{2(2)}$$

$$x = \frac{5 \pm \sqrt{33}}{4}$$

2 solutions

$x^2 - 30x + 225 = 0$

$$x = \frac{30 \pm \sqrt{900 - 4(1)(225)}}{2(1)}$$

$$x = \frac{30 \pm \sqrt{0}}{2}$$

1 solution

$3x^2 + 2x + 15 = 0$

$$x = \frac{-2 \pm \sqrt{4 - 4(3)(15)}}{2(3)}$$

$$x = \frac{-2 \pm \sqrt{-176}}{6}$$

no solution

Which part of the quadratic formula determines the number of zeros?

desmos

In $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$: the # under the $\sqrt{}$ is the discriminant, it determines whether there will be 2, 1 or 0 solutions.

- If $b^2 - 4ac > 0$, then the quadratic equation has 2 real roots.
- If $b^2 - 4ac = 0$, then the quadratic equation has 1 real root.
- If $b^2 - 4ac < 0$, then the quadratic equation has no real roots.

Ex. 1 Determine the discriminant, then state the number of roots (solutions/zeroes).

a) $0 = 3x^2 + 7x + 9$

$$b^2 - 4ac = 7^2 - 4(3)(9)$$
$$= 49 - 108$$
$$= -59$$

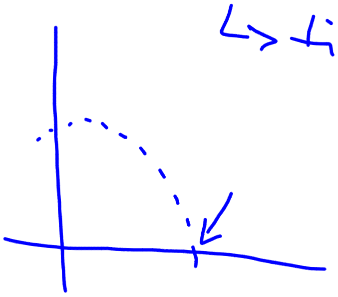
$\therefore$ No real roots

b) $0 = 5x^2 - 8x - 3$

$$b^2 - 4ac$$
$$= (-8)^2 - 4(5)(-3)$$
$$= 64 + 60$$
$$= 124$$

$\therefore$ 2 real roots

Ex. 2 A cliff diver in Acapulco, Mexico, dives from about 17m above the water. The diver's height above the water h, in meters, after t seconds is modelled by $h = -4.9t^2 + 1.5t + 17$. How long is the diver in the air?



↳ time when $h = 0$?

$\therefore$ let $h = 0$

$0 = -4.9t^2 + 1.5t + 17$

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

$$x = \frac{-1.5 \pm \sqrt{(1.5)^2 - 4(-4.9)(17)}}{2(-4.9)}$$

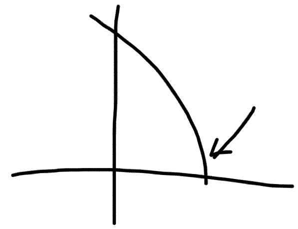
$$x = \frac{-1.5 \pm \sqrt{335.45}}{-9.8}$$

$t \doteq \cancel{-1.72}$ Invalid $\qquad$ $t \doteq 2.02$

$\therefore$ He was in the air for approx. 2.0 seconds.

Ex.3 The height of an object thrown downward off the Peace tower is given by $h = -5t^2 - 5t + 90$, where h is the height above the ground in metres and t is the time in seconds. How long does it take for the object to hit the ground?

When it hits the ground, $h = 0$



$$-5t^2 - 5t + 90 = 0$$

$$-5(t^2 + t - 18) = 0$$

$a = 1$
$b = 1$
$c = -18$

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

$$= \frac{-1 \pm \sqrt{1 - 4(1)(-18)}}{2(1)}$$

$$= \frac{-1 \pm \sqrt{73}}{2}$$

$\cancel{t \doteq -4.77}$ Invalid

$t \doteq 3.77$

∴ The object is in the air for approx. 4 seconds.

Ex. 4 A ball is thrown up into the air. Its height h, in metres, after t seconds is $h = -4.9t^2 + 38t + 1.75$.

a) What is the height of the ball after 3 s?

b) For what length of time is the ball above 50m?

c) When does the ball strike the ground?

a) Sub in $t=3$

$$h = -4.9(3)^2 + 38(3) + 1.75$$
$$= 71.65$$

$\therefore$ After 3s, the ball's height is 71.65m

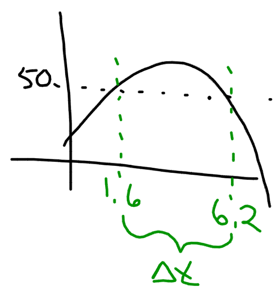
b) $t = ?$ when $h = 50$

$$50 = -4.9t^2 + 38t + 1.75$$
$$0 = -4.9t^2 + 38t - 48.25$$

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

$$= \frac{-38 \pm \sqrt{38^2 - 4(-4.9)(-48.25)}}{2(-4.9)}$$

$t \doteq 1.6$ or $t \doteq 6.2$



$$\Delta t = 6.2 - 1.6$$
$$= 4.6$$

$\therefore$ It was at or above 50m for 4.6s

c) $t = ?$ $h = 0$

$$0 = -4.9t^2 + 38t + 1.75$$

$\boxed{\text{Answer } t \doteq 7.8}$

FBUHL!

FBUHL
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