

<https://www.google.ca/#q=you+tube+quadratic+formula>

5.6 Quadratic Formula Problems



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

Number of
Roots

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

: the # under the $\sqrt{\quad}$ ie. the **discriminant** determines whether there will be 2, 1 or 0 solutions.

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

negative

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

$$a=3 \quad b=7 \quad c=9$$

$$\text{a) } 0 = 3x^2 + 7x + 9$$

$$\begin{aligned} b^2 - 4ac \\ &= (7)^2 - 4(3)(9) \\ &= 49 - 108 \\ &= -59 \end{aligned}$$

NO REAL ROOTS

$$a=5 \quad b=-8 \quad c=-3$$

$$\text{b) } 0 = 5x^2 - 8x - 3$$

$$\begin{aligned} b^2 - 4ac \\ &= (-8)^2 - 4(5)(-3) \\ &= 64 + 60 \\ &= 124 \end{aligned}$$

Two 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 the equation

$$h = -4.9t^2 + 1.5t + 17.$$

How long is the diver in the air?

$$t = ? \quad h = 0$$

$$a = -4.9 \quad b = 1.5 \quad c = 17$$

$$0 = -4.9t^2 + 1.5t + 17 \rightarrow \text{Solve for } t; \text{ How?}$$

\rightarrow Quadratic formula
 \rightarrow factoring

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

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

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

$$t = \frac{-1.5 + \sqrt{335.45}}{-9.8}$$

$$t = \frac{-1.5 - \sqrt{335.45}}{-9.8}$$

$$t = -1.7$$

inadmissible [C]

$$t = 2.0$$

\therefore Diver hit the water after 2.0 s.



Ex. 3 The height of an object thrown downward off the Peace tower is given by the equation $h = -5t^2 - 5t + 90$, 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?



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?



a) $h = ? \quad t = 3$

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

$$\approx 71.65$$

∴ The height of the ball is exactly 71.65m after 3 seconds.

b) $t = ? \quad h = 50$

$$50 = -4.9t^2 + 38t + 1.75 \quad \leftarrow \text{Solve for 't'}$$

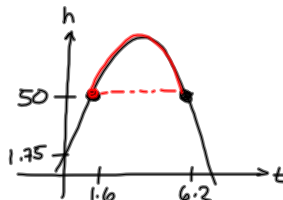
$$0 = -4.9t^2 + 38t + 1.75 - 50 \quad \leftarrow \text{How move all terms to one side}$$

$$0 = -4.9t^2 + 38t - 48.25 \quad \text{Quad Form}$$

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

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

$$= \frac{-38 \pm \sqrt{498.3}}{-9.8}$$



$$t = \frac{-38 + \sqrt{498.3}}{-9.8}$$

$$t = 1.6$$

$$t = \frac{-38 - \sqrt{498.3}}{-9.8}$$

$$t = 6.2$$

$$\text{time above 50 m} = 6.2 - 1.6$$

$$= 4.6 \text{ s}$$

∴ Ball was above 50 m for 4.6 s.

c) When does the ball strike the ground?

→ zeros / roots $t = ? \quad h = 0$

$$0 = -4.9t^2 + 38t + 1.75 \quad \text{Solve} \rightarrow \text{Quad form}$$

$$t = \frac{-38 \pm \sqrt{38^2 - 4(-4.9)(1.75)}}{2(-4.9)}$$

$$t = \frac{-38 \pm \sqrt{1478.3}}{-9.8}$$

$$t = \frac{-38 + \sqrt{1478.3}}{-9.8}$$

$$t \approx -0.05$$

inadmissible

$$t = \frac{-38 - \sqrt{1478.3}}{-9.8}$$

$$t \approx 7.8$$

∴ Ball hit ground after 7.8 s

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#6, 7, *10, 11, *13, 14, 18

* Using the quadratic formula is not the most efficient way to solve these problems. What is?

