

Solving Equations: Vertex Form & Quadratic FormulaApr. 25/
2016Recall: To solve by factoring,

- (1) collect all terms on one side of equal sign
- (2) factor the expression
- (3) use $(a)(b) = 0$ to state $a = 0$ or $b = 0$

Consider this example:

$$x^2 - 12x + 32 = 0$$

$$(x - 8)(x - 4) = 0$$

$$x - 8 = 0 \quad x - 4 = 0$$

$$x = 8 \quad x = 4$$

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Vertex form can also be very useful for solving a quadratic equation.

- Ex.1 (a) Write $y = x^2 - 12x + 32$ in vertex form
 (b) Solve for $y = 0$

$$\begin{aligned} \text{(a)} \quad y &= x^2 - 12x + 32 & -\frac{12}{2} &= -6 \\ y &= x^2 - 12x + 36 - 36 + 32 & (-6)^2 &= 36 \\ y &= (x-6)^2 - 4 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \text{set } y &= 0 & 0 &= a^2 - 4 \\ 0 &= (x-6)^2 - 4 & 4 &= a^2 \\ 4 &= (x-6)^2 & \sqrt{a^2} &= \pm \sqrt{4} \\ (x-6)^2 &= 4 & a &= \pm 2 \\ x-6 &= \pm \sqrt{4} & \text{or } a &= 2 \text{ or } a = -2 \\ x-6 &= \pm 2 & \\ x-6 &= 2 \quad \text{or } x-6 = -2 & y &= 0 \\ x &= 8 \quad \boxed{x=8} & \text{zeroes for} & \\ x &= 4 \quad \boxed{x=4} & \text{parabola} & \end{aligned}$$

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If factoring is not possible use the quadratic formula:

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

which is derived from completing the square (p.337-338).

Note: To use the quadratic formula, the equation must be in standard form, $ax^2 + bx + c = 0$.

The ' \pm ' symbol means there are two solutions.

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

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Ex.3 Solve using the quadratic formula.

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

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

$a=1 \quad b=-4 \quad c=-3$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-3)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{16 + 12}}{2}$$

$$x = \frac{4 \pm \sqrt{28}}{2}$$

$$x = \frac{4 + \sqrt{28}}{2} \quad \text{or} \quad x = \frac{4 - \sqrt{28}}{2}$$

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

$$a = 1 \quad b = -2 \quad c = -5$$

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

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

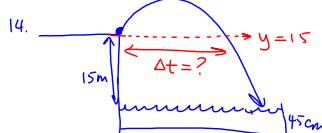
$$x = \frac{2 \pm \sqrt{4 + 20}}{2}$$

$$x = \frac{2 \pm \sqrt{24}}{2}$$

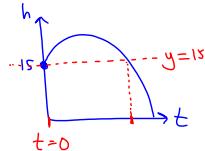
$$x = \frac{2 + \sqrt{24}}{2} \text{ or } x = \frac{2 - \sqrt{24}}{2}$$

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Assigned Work:

p.343 # 1ad, 3, 4bdf, 5ace, 8bdf, 9ad,
10cd, 14, 19*

$$h = -4.9t^2 + 1.2t + 15$$

(a) set $h = 15$, solve

$$15 = -4.9t^2 + 1.2t + 15$$

$$0 = -4.9t^2 + 1.2t$$

$$\alpha = -4.9 \quad b = 1.2 \quad c = 0 \quad \checkmark$$

OR

$$0 = t(-4.9t + 1.2)$$

$$t = 0 \quad -4.9t + 1.2 = 0$$

;

(b) start at $t = 0, h = 15$ end when $t = ?, h = 0$

$$0 = -4.9t^2 + 1.2t + 15$$

$$\alpha = -4.9 \quad b = 1.2 \quad c = 15$$

$$19. (b) x = \frac{2 \pm \sqrt{5}}{3}$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\begin{aligned} -b &= 2 & 2a &= 3 \\ b &= -2 & a &= 1.5 \end{aligned}$$

$$b^2 - 4ac = 5$$

$$(-2)^2 - 4(1.5)c = 5$$

$$4 - 6c = 5$$

$$-6c = 1$$

$$c = -\frac{1}{6}$$

$$y = ax^2 + bx + c$$

$$y = \frac{3}{2}x^2 - 2x - \frac{1}{6}$$

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