Quadratic Equations Study Guide

Calculator Inactive

2.) What is the smallest of three consecutive positive integers if the product of the smaller two integers is 4 less than 4 times the largest integer?

$n = 1^{st}$ int.
$n+1 = 2^{nd}$ int.
$n+2 = 3^{rd}$ int.

$n+2$

$n(n+1) = 4(n+2) - 4$

$n^2 + n = 4n + 8 - 4$

$n^2 + n = 4n + 4$

$\underline{-4n-4 \quad -4n-4}$

$n^2 - 3n - 4 = 0$

$(n+1)(n-4) = 0$

$n+1 = 0 \qquad n-4 = 0$

$n = -1 \qquad n = 4$

neg!

3.) The larger leg of a right triangle is 4 inches longer than the shorter leg. The hypotenuse is 8 inches longer than the shorter leg. Use the Pythagorean Theorem to find the length of the shorter leg.

x , $x+8$, $x+4$
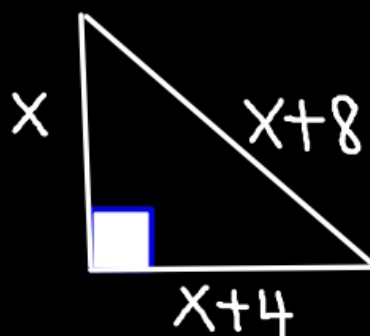
$a^2 + b^2 = c^2$

$x^2 + (x+4)^2 = (x+8)^2$

$x^2 + x^2 + 8x + 16 = x^2 + 16x + 64$

$2x^2 + 8x + 16 = x^2 + 16x + 64$

$\underline{-x^2 - 16x - 64 \quad -x^2 - 16x - 64}$

$x^2 - 8x - 48 = 0$

$(x+4)(x-12) = 0$

$x+4 = 0 \qquad x-12 = 0$
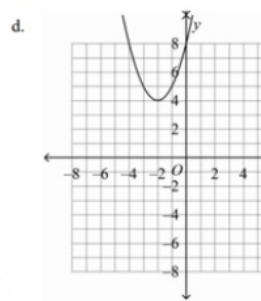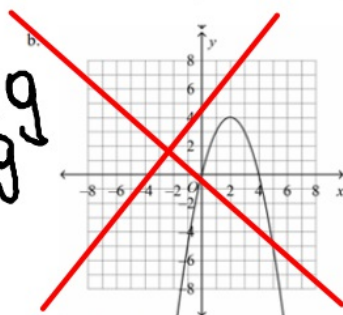
$x = -4 \qquad x = 12$

neg!

4.) A company models its net income, in thousands of dollars, with the function, $p(n) = 2n^2 + 6n - 108$, where x is the number of units of its product sold. How many units of its product does the company need to sell in order for the net income to equal $0?

$$p(n) = 2n^2 + 6n - 108$$
$$2n^2 + 6n - 108 = 0$$
$$2(n^2 + 3n - 54) = 0$$
$$2(n+9)(n-6) = 0$$
$$\cancel{2=0} \quad n+9 = 0$$
$$n = -9$$
$$n - 6 = 0$$
$$n = 6 \text{ pRoducts}$$

5.) Which is the graph of $y = (x-2)^2 + 4$?

a.

c. y-int.
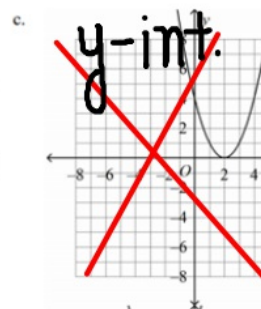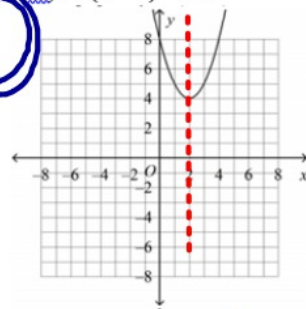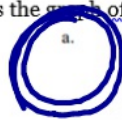
b. facing WRONg way

d.

$$Y = (x-2)^2 + 4$$
$$= x^2 - 4x + 4 + 4$$
$$Y = x^2 - 4x + 8 \quad \text{y-int.}$$
$$X = \frac{4}{2(1)} = 2$$
$$X = 2$$

6.) What is the negative root of $y = 4x^2 - 36$?

-3

$4(x^2 - 9) = 0$

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

$4 = 0 \quad x+3 = 0 \quad x-3 = 0$

$\{x = -3\}$

~~$4 \ne 0$~~

7.) What is the value of the larger zero of $y = 4x^2 + 10x - 24$?

$2(2x^2 + 5x - 12)$

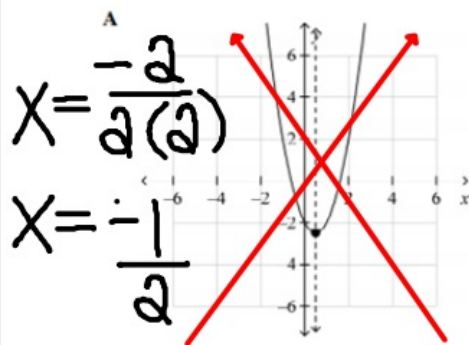$(2)(2x^2 - 3x + 8x - 12) = 0$

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

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

$2x - 3 = 0 \quad x+4 = 0$

$2x = 3 \qquad x = -4$

$\{x = 3/2\}$

8.) Graph $f(x) = 2x^2 + 2x - 2$. Label the vertex and axis of symmetry.

$x = \dfrac{-2}{2(2)}$

$x = \dfrac{-1}{2}$

A

Axis of symmetry: $x = 0.5$
Vertex: $(0.5, -2.5)$

B

C
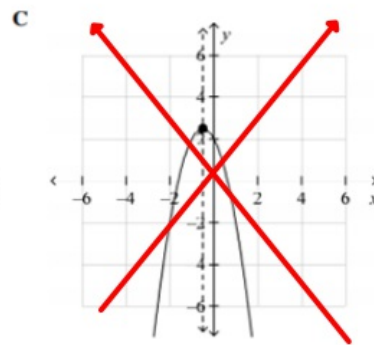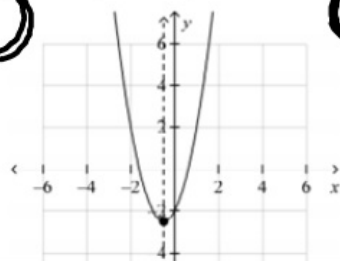
Axis of symmetry: $x = -0.5$
Vertex: $(-0.5, 2.5)$

D

#7

$n = 1^{st} \text{ int}$

$n + 1 = 2^{nd} \text{ int}$

$n^2 + \boxed{(n+1)^2} = 41$

box/foil

#9

$n = 1^{st} \text{ int}$

$n + 2 = 2^{nd} \text{ int}$

$\boxed{(n+2)^2} + 2n = 52$

box/foil
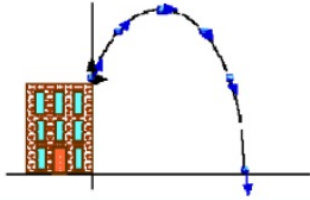
PROJECTILE MOTION

1. A soccer ball is kicked from the ground with an initial upward velocity of 90 feet per second. The equation $h = -16t^2 + 90t$ gives the height h of the ball after t seconds.
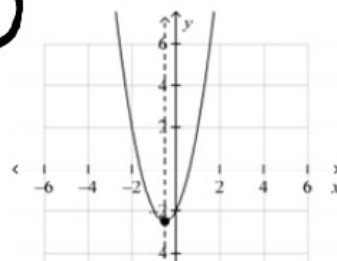
   a. Find the maximum height of the ball. → y-coor. of vertex

   b. How many seconds will it take for the ball to reach the ground?

1a. 126.56 ft

b. 5.625 s

$t = \dfrac{-90}{2(-16)} = 2.8125$

$h = -16(2.8125)^2 + 90(2.8125)$

126.5625

Roots!

$-16t^2 + 90t = 0$

$(-2t)(8t - 45) = 0$

$\dfrac{-2t}{-2} = \dfrac{0}{-2}$

$t = 0$

$8t - 45 = 0$

$\underline{+45 \quad +45}$

$8t = 45$

$t = 5.625$

2. An apple is launched directly upward at 64 feet per second from a platform 80 feet high. The equation for this apple's height h at time t seconds after launch is $h = -16t^2 + 64t + 80.$

a. Find the maximum height of the apple.

y-coor. of vertex

$$t = \frac{-64}{2(-16)} = 2 \quad h = -16(2)^2 + 64(2) + 80$$
$$h = 144 \text{ ft.}$$

b. How many seconds will it take for the apple to reach the ground?

$$-16t^2 + 64t + 80 = 0$$
$$-16(t^2 - 4t - 5) = 0$$
$$-16(t+1)(t-5) = 0$$
$$-16 = 0 \quad t+1 = 0 \quad t-5 = 0$$
$$t = -1 \quad t = 5$$

2a. 144 ft.

b. 5 sec.

3. In science class, the students were asked to create a container to hold an egg. They would then drop this container from a window 25 feet above the ground. The equation $h = -16t^2 + 25$ gives the container's height h after t seconds.

3a. 25 ft.

b. 1.25 sec.

a. Find the maximum height of the container.   → y-coor. of vertex

$$t = \frac{0}{2(-16)} = 0 \qquad h = -16(0)^2 + 25$$
$$h = 25$$

b. How many seconds will it take for the container to reach the ground?

$$-16t^2 + 25$$
$$-1(16t^2 - 25) = 0$$
$$-1(4t+5)(4t-5) = 0$$
$$-1 = 0 \quad 4t+5 = 0 \quad 4t-5 = 0$$
$$t = -\frac{5}{4} \qquad t = \frac{5}{4}$$

4. A penny is dropped off the Empire State Building, which is 1,250 feet tall. If the penny's pathway can be modeled by the equation $h = -16t^2 + 1250$, how long would it take the penny to strike a 6 foot tall person?

4. _____

5. Some fireworks are fired vertically into the air from the ground at an initial speed of 80 feet per second. The equation for this object's height h at time t seconds after launch is $h = -16t^2 + 80t$. How long will it take the fireworks to reach the ground?

5. _____

6. The Apollo's Chariot, a rollercoaster at Busch Gardens, moves at 110 feet per second. The equation of the ride can be represented by the equation $h = -16t^2 + 101t + 10$. What is the maximum height reached by this ride?

6. _____

7. Eva is jumping on a trampoline. Her height h at time t can be modeled by the equation $h = -16t^2 + 20t + 6$. Would Eva reach a height of 14 feet?

7. _____

8. An astronaut on the Moon throws a baseball upward with an initial velocity of 10 meters per second, letting go of the baseball 2 meters above the ground. The equation of the baseball pathway can be modeled by $h = -0.8t^2 + 10t + 2.$ The same experiment is done on Earth, in which the pathway is modeled by equation $h = -4.9t^2 + 10t + 2.$ How much longer would the ball stay in the air on the Moon compared to on Earth?

8. _____

Challenge!

One leg of a right triangle exceeds the other leg by four inches. The hypotenuse is 20 inches. Find the length of the shorter leg of the right triangle.

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