Analytic Geometry Quadratic Word Problems WS #2

Projectile Motion Formula	h(t) = final height (end of the problem)
$h(t) = \frac{1}{2}at^2 + v_i t + h_i$	a = acceleration due to gravity (-32 ft/s^2)
	v_i = initial velocity
	h_i = initial height (beginning of the problem)
	t = time (from initial height to final height)

1. An acrobat is shot upward from a cannon at 32 ft/sec from an initial height of 4 ft. How long does it take for an acrobat to land in a safety net that's 20 feet above the ground?

2. In anger, you throw a calculator down from a 240 foot building with an initial velocity of 32 ft/sec. How long will it take to hit the ground?

Projectile Motion Formula	h(t) = final height (end of the problem)
$h(t) = \frac{1}{2}at^2 + v_i t + h_i$	a = acceleration due to gravity (-32 ft/s^2)
	v_i = initial velocity
	h_i = initial height (beginning of the problem)
	t = time (from initial height to final height)

3. A pumpkin cannon launches your jack'o lantern with a vertical velocity of 96 ft/sec.

a. How long will it take for the pumpkin to reach a height of 128 feet?

b. How long will it take the pumpkin to be in the air (total time before landing)?

c. What is the maximum height of the pumpkin?

4.a) A projectile is shot straight upward from the ground with a velocity of 64 feet per second. How long will it take to hit the ground?

b. What is the maximum height of the projectile ?

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Key

Projectile Motion Formula

$h(t) = \frac{1}{2}at^2 + v_i t + h_i$

$h(t)$ = final height (end of the problem)

a = acceleration due to gravity (-32 ft/s^2) or (-9.8 m/s^2)

v_i = initial velocity

h_i = initial height (beginning of the problem)

t = time (from initial height to final height)

$h(t) = \frac{1}{2}(-32)t^2 + v_i t + h_i$

$h(t) = -16t^2 + v_i t + h_i$

1. An acrobat is shot upward from a cannon at 32 ft/sec from an initial height of 4 ft. How long does it take for an acrobat to land in a safety net that's 20 feet above the ground?

$h(t) = 20$

$v_i = 32$ ft/s

$h_i = 4$

$t =$ ____

$20 = -16t^2 + 32t + 4$

$-20 \quad -20$

$0 = -16t^2 + 32t - 16$

$0 = -16(1t^2 - 2t + 1)$

$a = 1$

$b = -2$

$c = 1$

$-1 \times -1 = 1$

$-1 + -1 = -2$

$-16(t-1)(t-1) = 0$

$t - 1 = 0$ | $t - 1 = 0$

$t = 1$ | $t = 1$

$t = 1$ second

2. In anger, you throw a calculator down from a 240 foot building with an initial velocity of 32 ft/sec. How long will it take to hit the ground?

$h(t) = -16t^2 + v_i t + h_i$

$h(t) = 0$

$v_i = -32$ ft

$h_i = 240$

$t =$ ____

$0 = -16t^2 - 32t + 240$

$0 = -16(1t^2 + 2t - 15)$

$a = 1$

$b = 2$

$c = -15$

$\frac{5}{1} \times \frac{-3}{1} = -15$

$\frac{5}{1} + \frac{-3}{1} = 2$

$0 = -16(t+5)(t-3)$

$t + 5 = 0$ | $t - 3 = 0$

$-5 \quad -5$ | $+3 \quad +3$

$t = -5$ | $t = 3$ seconds

Projectile Motion Formula	h(t) = final height (end of the problem)
$h(t) = \frac{1}{2}at^2 + v_i t + h_i$	a = acceleration due to gravity (-32 ft/s^2)
	v_i = initial velocity
	h_i = initial height (beginning of the problem)
	t = time (from initial height to final height)

3. A pumpkin cannon launches your jack'o lantern with a vertical velocity of 96 ft/sec.

$h(t) = -16t^2 + v_i t + h_i$

a. How long will it take for the pumpkin to reach a height of 128 feet?

$h(t) = 128$

$v_i = 96$

$h_i = 0$

$t =$ ____

$128 = -16t^2 + 96t + 0$

$0 = -16t^2 + 96t - 128$

$0 = -16(t^2 \quad)$

b. How long will it take the pumpkin to be in the air (total time before landing)?

$h(t) = 0$ $\quad 0 = -16t^2 + 96t$

$0 = -16t(t - 6)$

$t = 0, \; t = 6$ seconds

c. What is the maximum height of the pumpkin?

$x = \frac{-b}{2a} = \frac{-96}{2(-16)} = 3$

$h(3) = -16(3)^2 + 96(3) = 144$ ft.

4.a) A projectile is shot straight upward from the ground with a velocity of 64 feet per second. How long will it take to hit the ground?

$h(t) = 0$

$v_i = 64$

$h_i = 0$

$0 = -16t^2 + 64t + 0$

$0 = -16t(t - 4)$

$t = 0, \; t = 4$

$t = 4$ seconds

b. What is the maximum height of the projectile ?

$\frac{-b}{2a} = \frac{-64}{2(-16)} = 2$

$t = 2$ seconds

$h(2) = -16(2)^2 + 64(2)$

$h(2) = 64$ ft.