$y = ax^2 + bx + c$

Using Factoring to Solve Problems

For each problem, define the variable, draw a diagram as indicated, write an equation(s), and solve.

Projectiles, Finding Time

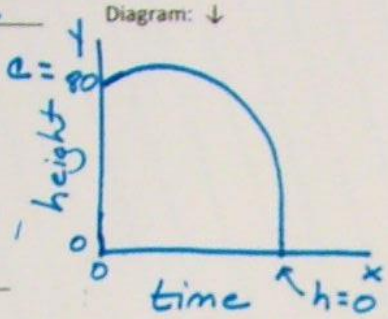
When height, h, is in feet: $h = -16t^2 + vt + c$
When height, h, is in meters: $h = -4.9t^2 + vt + c$
t is the time in motion (in seconds)
v is the initial upward velocity (in ft/sec or m/sec)
c is the initial height

EXAMPLES

1) A diver springs from the edge of a cliff 80 ft above the ocean with an initial velocity of 8 ft/sec. How long will it take the diver to reach the water? $c = 80$ $v = 8$

Variable: t = time

Diagram: ↓



Equation: $h = -16t^2 + vt + c$

$0 = -16t^2 + 8t + 80$

$0 = -8(2t^2 - t - 10)$

$0 = -8(2t - 5)(t + 2)$

$2t - 5 = 0$ $\quad t + 2 = 0$

$2t = 5$ $\quad t = -2$

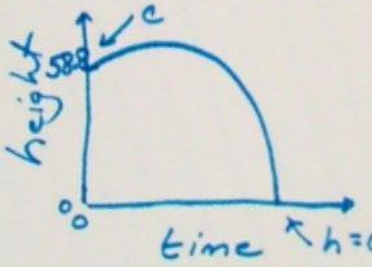
$t = 5/2 = 2\frac{1}{2}$

Solution: $2\frac{1}{2}$ sec

2) An object is launched at 19.6 meters per second (m/s) from a 58.8-meter tall platform. When does the object strike the ground? $h = 0$ $v = 19.6$

Variable: t = time

Diagram: ↓



Equation: $h = -4.9t^2 + vt + c$

$0 = -4.9t^2 + 19.6t + 58.8$

$0 = -4.9(t^2 - 4t - 12)$

$0 = -4.9(t - 6)(t + 2)$

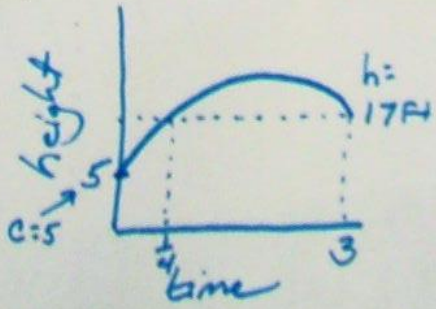
$t = 6$ $\quad t = -2$

Solution: 6 sec

3) At a pep rally, cheerleaders use a slingshot to launch small, foam basketballs into the crowd. The release point is 5 ft above the gym floor, and the balls are shot with an initial upward velocity of 52 ft/s. Suppose a ball is caught 17 ft above the floor on its way down by a student in the stands. How long is the ball in the air? $v = 52$

Variable: t = time

Diagram: ↓



Equation: $h = -16t^2 + vt + c$

$17 = -16t^2 + 52t + 5$

$0 = -16t^2 + 52t - 12$

$0 = -4(4t^2 - 13t + 3)$

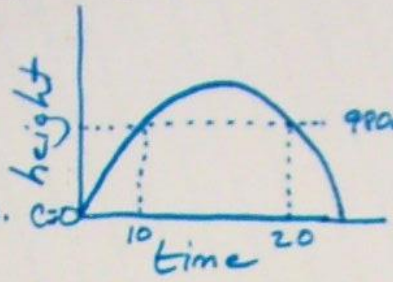
$0 = -4(4t - 1)(t - 3)$

$t = \frac{1}{4}$ $\quad t = 3$

Solution: 3 sec

4) A trebuchet launches a projectile on a parabolic arc at a velocity of 147m/s. Determine when the projectile will first reach a height of 980 m, and how many seconds later will it again be 980m.

Variable: t: time Diagram: ↓ Equation: $h = -4.9t^2 + vt + c$



$980 = -4.9t^2 + 147t + 0$

$0 = -4.9t^2 + 147t - 980$

$0 = -4.9(t^2 - 30t + 200)$

$0 = -4.9(t-20)(t-10)$

20 10

Solution: 10 sec. & 20 sec.

ASSIGNMENT

1) Bryson throws a baseball into the air with an initial velocity of 46 ft/s. He releases the ball 6 feet off of the ground. When will the ball hit the ground?

Variable: _____ Diagram: ↓ Equation: _____

Solution: _____

2) An object is launched from ground level directly upward at 39.2 m/s. For how long is the object at or above a height of 34.3 meters?

Variable: _____ Diagram: ↓ Equation: _____

Solution: _____

3) At a pep rally, cheerleaders use a slingshot to launch t-shirts into the crowd. The release point is 5 ft above the gym floor, and the t-shirts are shot with an initial upward velocity of 36 ft/s. Suppose a t-shirt is caught 13 ft above the floor on its way down by a student in the stands. How long is the t-shirt in the air?

Variable: _____ Diagram: ↓ Equation: _____

Solution: _____