**Day 7: Solve Problems Using Quadratic Equations**

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**Warm-Up:** The height, *h* metres, of a springboard diver above the surface of

the water *t* seconds after he leaves the board is given by *h = -5t2 + 10t + 3*.

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| 1. How high was the diving board? | 1. When does he hit the water? |
| 1. Determine the diver’s maximum height above the water. | 1. For how long is he above a height of 5 m? |

1. An equation representing the height of a flare, *h* metres, above the release position, after *t* seconds, is *h = -5t2 + 100t.*
   1. What is the height of the flare after 3 s? (255 m)
   2. What is the maximum height reached by the flare? (500 m)
   3. What is the height of the flare after 25 s? (-625 m)
   4. Does your answer in part c make sense? Explain. (No . . .)
   5. Determine the time for which the flare is higher than 80 m. (18.3 s)
2. When a flare is fired vertically upward, its height, *h* metres, after *t* seconds is modelled by the equation *h = -5t2 + 153.2t*.
   1. Is the flare on the ground or on a stand? (ground)
   2. How long is the flare in the air? (30.64 sec)
   3. What is the maximum height of the flare? (1173.5 m)
   4. For how many seconds is the flare higher than 1 km. (11.78 s)
3. A rectangular lot is bounded on one side by a river and on the other three sides by a total of 30 m of fencing. A formula that represents the area of the lot, *A* square metres, in terms of its width, *x* metres, is *A = 30x – 2x2.* Calculate the dimensions of the largest possible lot. (7.5 m by 7.5 m)
4. A ball is dropped over the roof of a building. The equation to model this scenario is: *h = -16t2 + 75*, where *h* is the height of the building in feet after *t* seconds.
   1. How high is the building? (75 ft)
   2. How long does it take the ball to land? (4.69 sec)
5. The power, *P* watts, supplied to a circuit by a 9-V battery is given by the formula *P = 9I – 0.5I2*, where *I* is the current in amperes. What is the maximum power? (40.5 W)
6. Computer software programs are sold to students for $20 each. Three hundred students are willing to buy them at this price. For every $5 increase in price, there are 30 fewer students willing to buy the software. A formula that represents the revenue, *R* dollars, for an *x* dollar increase in price is *R = -6x2 + 180x + 6000*. Calculate the selling price that will produce the maximum revenue. What is the maximum revenue? ($15, $7350)
7. When a baseball is hit at a certain velocity and angle the height of the ball is given by the equation *h = -0.0032x2 + x + 3*, where *h* is the height of the ball in feet, and *x* is the horizontal distance from home plate in feet.
   1. How high was the ball when it was hit? (3 ft)
   2. How high is the ball when it is 2 ft away from home plate? (4.98 ft)
   3. How far away from home plate does the ball land? (315.47 ft)
   4. What is the maximum height reached by the baseball? (81.125 ft)
8. Forty metres of fencing are available to enclose a rectangular pen. The area, *A* square metres, enclosed is given by *A = 20x – x2*, where the length of the pen is *x* metres.
   1. What is the maximum area that can be enclosed? (100 m2)
   2. What are the dimensions of the pen with the maximum area? (10 m by 10 m)
   3. What length produces a pen with an area greater than 90 m2? (between 6.9 m and 13.1 m)
9. A company manufactures and sells designer T-shirts. The profit, *P* dollars, for selling a certain style of T-shirt is projected to be *P = -20x2 + 1000x – 6720*, where *x* dollars is the selling price of one T-shirt.
10. What are the break even points? ($8 and $42)
11. What selling price gives the maximum profit? What is the maximum profit? ($25, $5780)
12. A life guard marks a rectangular swimming area at a beach with a 200 m rope. The width of the swimming area is *x* metres. The area enclosed is *A* square metres, where *A = x(200 – 2x).*  What is the greatest area that can be enclosed? (5000 m2)
13. A company manufactures and sells novelty caps. The profit, *P* dollars, for selling a certain style of cap at *t* dollars each is projected to be *P = -15t2 + 90t + 675*. What selling price is expected to give a maximum profit? What is the maximum profit? ($3, $810)
14. A stone is thrown upward with an initial speed of 25 m/s. Its height, *h* metres, after *t* seconds is given by the equation *h = -5t2 + 25t*. For how long is the stone higher than 30 m? (1 sec)
15. When a flare is fired upward at 58.8 m/s, its height, *h* metres, is given by the equation *h = -4.9t2 + 58.8t*, where *t* seconds is the time since firing.
16. Determine the maximum height of the flare and the time it takes to reach this height. (176.4 m, 6 s)
17. For how many seconds is the flare higher than 98 m? (8 s)

Seatwork: p. 311 #2-6, 8