Unit 5 Review Questions

1. Skydivers jump out of an airplane at an altitude of 3.5 km. The equation $H = 3500 - 5t^2$ models the altitude, H, in metres, of the skydivers, at t seconds after jumping out of the airplane.

a) How far have the skydivers fallen after 10 s?

b) The skydivers open their parachutes at an altitude of 1000m. How long did they free fall?

#1. a) $H = 3500 - 5(10)^2$

$= 3500 - 500$

$= 3000$

$\therefore$ They fell 500 m in 10 s.

$3500 - 3000 = 500$

b) Let H be 1000, solve.

$1000 = 3500 - 5t^2$

$5t^2 = 2500$

$t^2 = \frac{2500}{5}$

$t^2 = 500$

$t = \pm\sqrt{500}$

$t \doteq \pm 22.4$

inad.

$\therefore$ They freefall for 22.4 s.

2. Katie sells specialty teddy bears at various summer festivals. Her profit for a week , P, in dollars, can be modelled by $P = -0.1n^2 + 30n - 1200$, where n is the number of teddy bears she sells during the week.

a) How many teddy bears would she have to sell to earn $500?

b) How many teddy bears would she have to sell to break even? Set P=0.

c) How many teddy bears would she have to sell to maximize her profit?

#2. $P = -0.1n^2 + 30n - 1200$

Set $P = 500$ and solve.

$500 = -0.1n^2 + 30n - 1200$

$0 = -0.1n^2 + 30n - 1700$

$$n = \frac{-30 \pm \sqrt{30^2 - 4(0.1)(-1700)}}{2(-0.1)}$$

$n \doteq 75.8$ or $n \doteq 224.2$

∴ You get a profit of $500 will either 76 or 224 teddy bears.

b) Set P=0, solve.

$-0.1n^2 + 30n - 1200 = 0$

$$n = \frac{-30 \pm \sqrt{30^2 - 4(-0.1)(-1200)}}{2(-0.1)}$$

$n \doteq 47.5$ or $n \doteq 252.5$

∴ To breakeven (don't make any $, but don't lose any either), she needs to sell about 48 or 253 teddy bears.

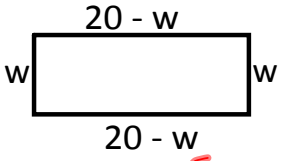
c) To find max. pt average the zeros or complete the square.

$$n = \frac{47.5 + 252.5}{2}$$

$n = 150$

∴ To max. profit sell 150 teddy bears.

3. Determine the dimensions of a rectangle that has a perimeter of 40 cm and has a maximum area. What is the maximum area?

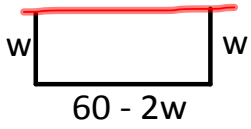


$2w + 2l = 40$
$2l = 40 - 2w$
$l = 20 - w$

$A = w(20 - w)$
$A = -w^2 + 20w$
$A = -(w^2 - 20w + 100 - 100)$
$A = -(w - 10)^2 + 100$

∴The max area is 100 cm^2 and occurs when the width and length are both 10 cm (i.e. when the rectangle is a square!).

4. A farmer wants to make a rectangular corral along the side of a large barn and has only 60m of fencing. Only 3 sides must be fenced, since the barn will form the fourth side. What should the dimensions of the corral be in order to enclose the maximum area?



$A = w(60 - 2w)$
$A = -2w^2 + 60w$
$A = -2(w^2 - 30w + 225 - 225)$
$A = -(w - 15)^2 + 450$

∴To maximize the area of the corral, the width should be 15m and the length should be 30m.

5. Find two numbers whose sum is 34 and whose product is a maximum.

Let x be one of the numbers.
Then 34-x is the other number

$P = x(34-x)$
$= -x^2+34x$
$= -(x^2-34x+289-289)$
$= -(x-17)^2+289$
$\therefore x = 17$

∴The numbers are both 17 (giving a max product of 289).

6. The path of a basketball shot can be modelled by the equation:

$$h = -0.09d^2 + 0.9d + 2$$

where h is the height of the basketball in metres and d is the horizontal distance of the ball from the player in metres. What is the maximum height reached by the ball? Complete the square to find max height of 4.25m.

7. Give an example of a quadratic ~~equation~~ relation with

a) no real roots: $y = (x-2)^2 + 4$

b) one real root: $y = (x-4)^2$

c) two real roots: $y = -(x-2)^2 + 4$

Review in Text

Pg. 316 # 1-14 (omit #12)

Pg. 318 #1-18

Reviewing tests #3 and #4 would also be a good idea!