Before we begin, are there any questions from last day's work?

2 (we'll do) 2 (already done) 3 (we'll do) 3 (already done) 4 (we'll do) 4 (already done)

Today's Learning Goal(s):

By the end of the class, I will be able to:

a) rearrange a formula for a specified variable

3.7.1 Connecting Formulae

Date: Apr. 1/16

Ex. 1 The formula $d = v_0 t + \frac{1}{2}at^2$ relates the distance, d, travelled by an object to its initial velocity, v_0, acceleration, a, and the elapsed time, t.
Determine the acceleration of a dragster that travels 500 m from rest in 15 s, by first isolating a, and then by first substituting known values. Compare and evaluate the two methods.

d : m
v : m/s
a : m/s/s
$= m/s^2$
t : s

Solutions

Method 1: Isolate a first.

$$d = v_0 t + \frac{1}{2}at^2$$
$$d - v_0 t = \frac{1}{2}at^2$$
$$2(d - v_0 t) = at^2$$
$$\frac{2(d - v_0 t)}{t^2} = a$$
$$\therefore a = \frac{2(d - v_0 t)}{t^2}$$
$$d = 500\ m,\ t = 15\ s,\ v_0 = 0\ m/s$$
$$a = \frac{2((500) - (0)(15))}{(15)^2}$$
$$= \frac{1000}{225}$$
$$\doteq 4.44\ m/s^2$$

Method 2: Substitute first.

$$d = v_0 t + \frac{1}{2}at^2$$
$$d = 500\ m,\ t = 15\ s,\ v_0 = 0\ m/s$$
$$500 = (0)(15) + \frac{1}{2}a(15)^2$$
$$500 = \frac{1}{2}a(225) \rightarrow 1000 = 225a$$
$$\frac{1000}{225} = a$$
$$500 = 112.5\ a$$
$$\frac{500}{112.5} = a$$
$$a \doteq 4.44\ m/s^2$$

3.7.2 1-14, 1-18

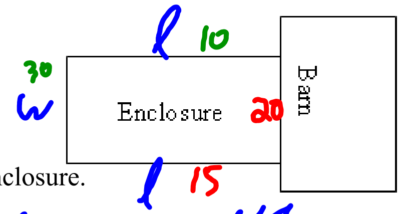
3.7.3 2c,d,f, 3a,b,c

(Continue to work ahead on Review 3.9.1)

$$x = \frac{y-7}{2} \quad x = \frac{7-y}{-2}$$
$$= -\left(\frac{7-y}{2}\right)$$
$$= \frac{-7+y}{2}$$

Return

2. A farmer needs to enclose a rectangular area using 50 m of fencing.
   One of the sides of the enclosure is against the barn.
   If the area of the enclosure is 300m², determine the dimensions of the enclosure.



Let ℓ + w represent the length + width respectively in m.

$A = \ell w$ $\qquad 2\ell + w = 50$

$300 = \ell w$ $\qquad w = 50 - 2\ell$

$300 = \ell(50 - 2\ell)$

$300 = 50\ell - 2\ell^2$

$2\ell^2 - 50\ell + 300 = 0$

$2(\ell^2 - 25\ell + 150) = 0$

$2(\ell - 10)(\ell - 15) = 0$

$\therefore \ell = 10$ or $\ell = 15$

if $\ell = 10$ m

then $w = 50 - 2(10)$

$= 30$ m

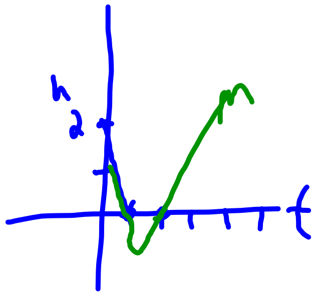
if $\ell = 15$ m

then $w = 50 - 2(15)$

$= 50 - 30$

$= 20$ m

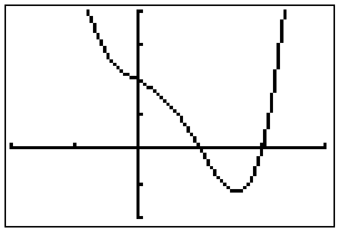
3. The function, $h = t^4 - 2t^3 - t + 2$, models the path of a seagull trying to catch fish, where h represents the seagull's height above the water in metres and t represents the time in seconds.
   a) At what height is the seagull when it first sees the fish?
   b) When does the seagull hit the water?
   c) At what time does the seagull leave the water with the fish in its beak?



a) $h(t) = t^4 - 2t^3 - t + 2$

if $t = 0$, $h(t) = 2$

$\therefore$ the seagull is 2 m above the water.

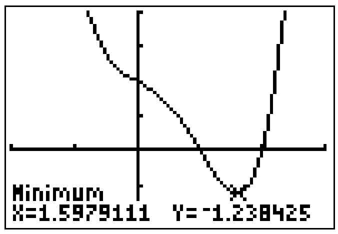


b) when $h = 0$ or ~~let~~ $h(t) = 0$

$0 = t^4 - 2t^3 - t + 2$

$= t^3(t-2) - 1(t-2)$

$= (t-2)(t^3 - 1)$



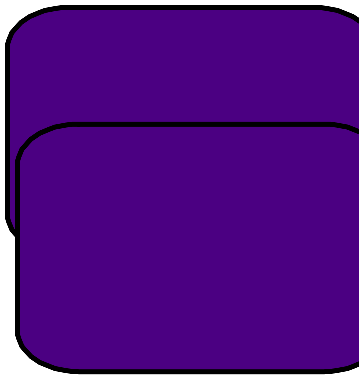
$t - 2 = 0$

$t = 2$

$t^3 - 1 = 0$

$t^3 = 1$

$t = \sqrt[3]{1}$



$\therefore$ the seagull hits the water at 1 sec. (and leaves the water at 2 sec.)

4. Melissa is running a ski trip during the exam break. Return
   The bus holds 40 students and if she charges \$250 per student the bus will be filled.
   For every \$25 increase in the price she charges students, two fewer students will go on the trip.
   a) Write an equation to model Melissa's revenue.
   b) Determine the maximum revenue.
   c) How many students need to go on the trip for Melissa to earn \$8800?

a) Revenue = $p \times$ number of students

$= p(60 - 0.08p)$

$= 60p - 0.08p^2$

$= -0.08p^2 + 60p$

number of \$25 inc: $\dfrac{p-250}{25}$ 300 $\dfrac{50}{25}$ 2

$40 - 2\left(\dfrac{p-250}{25}\right)$

$= 40 - \dfrac{2}{25}(p-250)$

$= 40 - 0.08(p-250)$

$= 40 - 0.08p + 20$

$= 60 - 0.08p$

b) $x = \dfrac{-b}{2a}$

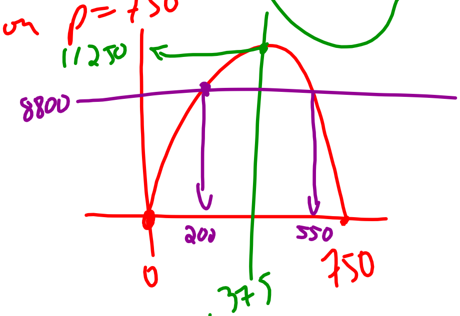
Max Revenue occurs at the vertex

$R = -0.08p^2 + 60p$

$= -0.08p(p - 750)$

if $R = 0$

$p = 0$ or $p = 750$



$x = \dfrac{-b}{2a}$

$= \dfrac{-(60)}{2(-0.08)}$

$= 375$

$\therefore$ max occurs when $p = 375$

$R = -0.08(375)^2 + 60(375)$

$= 11\,250$

$R = -0.08p^2 + 60p$

$8800 = -0.08p^2 + 60p$

$0.08p^2 - 60p + 8800 = 0$

$0.08(p^2 - 750p + 110\,000) = 0$

$0.08(p - 200)(p - 550) = 0$

$\therefore p = 200$ or $p = 550$

#students $= \dfrac{8800}{200}$ or $\dfrac{8800}{550}$

$= 44$ $= 16$

$\therefore$ 16 students would be on the trip.

4. Melissa is running a ski trip during the exam break.
The bus holds 40 students and if she charges \$250 per student the bus will be filled.
For every \$25 increase in the price she charges students, two fewer students will go on the trip.
a) Write an equation to model the Melissa's revenue.
b) Determine the maximum revenue.
c) How many students need to go on the trip for Melissa to earn \$8800?

Return

a) Revenue = price x number of tickets

$$= p(-0.08p + 60)$$
$$= -0.08p^2 + 60p$$

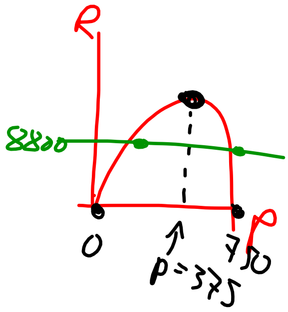
$$40 - 2\left(\frac{p-250}{25}\right)$$
$$= 40 - \frac{2}{25}(p - 250)$$
$$= 40 - \frac{2}{25}p + 20$$
$$= -\frac{2}{25}p + 60$$
$$= -0.08p + 60$$

b) $R = -0.08p^2 + 60p$

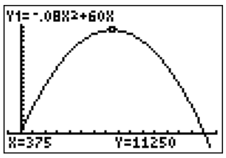
$$= -0.08p(p - 750)$$

$p = 0$ or $p = 750$

$$x = \frac{-b}{2a}$$



the max. revenue would occur when ticket price is set at \$375
(the max. revenue would be \$11250, from 30 tickets being sold. 11250÷375=30)

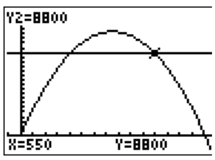


c) $8800 = -0.08p^2 + 60p$

$$0.08p^2 - 60p + 8800 = 0$$
$$0.08(p^2 - 750p + 11000) = 0$$
$$0.08(p - 550)(p - 200) = 0$$

$p = 550$ or $p = 200$

to earn a revenue of \$8800, ticket price must be set at \$550
(resulting in only 16 tickets being sold 8800÷550=16)
or the ticket price must be set at \$200
(resulting in 44 tickets needing to be sold 8800÷200=44)
[What is the problem with this idea?]



Melissa is best off setting the price at \$375