Math 1030 #14c

Linear Modeling

Applications

Linear Function

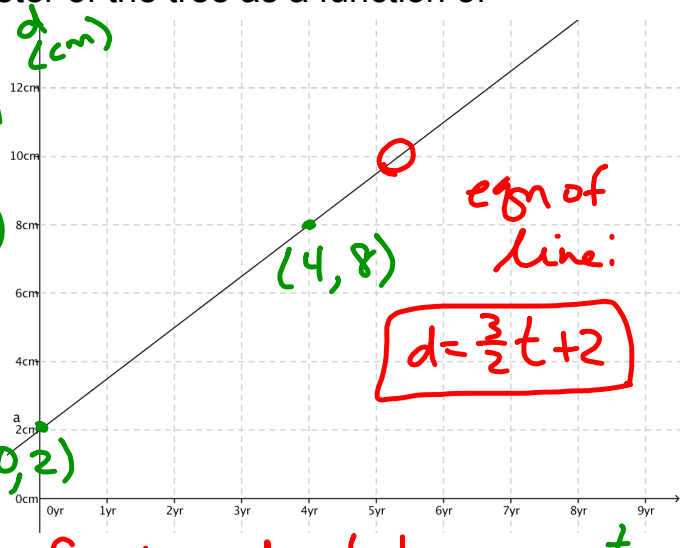
Linear Equation

Rate of Change

Price-Demand Function

EX 1: When your first child is born, you purchase a tree to plant. This graph shows the diameter of the tree as a function of time after you planted it.

input (indep. var.) = t = time
output (dep. var.) = diam. = d



a) How much does the diameter increase each year? (slope = ?)

$m = \frac{8-2}{4-0} = \frac{6}{4} = \frac{3}{2}$ cm/yr

b) When is the diameter 10 cm? $t = ?$, $d = 10$

$10 = \frac{3}{2}t + 2$

$8 = \frac{3}{2}t \Rightarrow t = \frac{16}{3} = 5\frac{1}{3}$ yr

c) What was the diameter when you planted the tree?

$d = ?$ when $t = 0$, $d = \frac{3}{2}(0) + 2 = 2$ cm

eqn of line: $d = \frac{3}{2}t + 2$

find b: $d = mt + b$

$2 = \frac{3}{2}(0) + b$

$b = 2$

d) When the child is six, what is the diameter of the tree?

when $t = 6$ yrs, $d = ?$

$d = \frac{3}{2}(6) + 2 = 9 + 2 = 11$ cm

e) Write an equation of this relationship.

(we already did that above)

$d = \frac{3}{2}t + 2$

EX 2: Your prize-winning ant colony is in a state of emergency. The population is declining at a linear rate and there is nothing you can do about it. You make a table of the population of ants:

$n = mt + b$

(indep var) days since start of year

(dep var) number of ants

t	18	34	62	84
n	9328	8872	8074	7747

a) Find a linear equation that describes your ant colony population as a function of the number of days since the beginning of the year.

① find m: (18, 9328) (34, 8872)

$m = \frac{9328 - 8872}{18 - 34} = \frac{456}{-16} = -28.5$ ants/days

② find b: $9328 = -28.5(18) + b \Rightarrow b = 9841$ ants

③ $n = -28.5t + 9841$

b) How many ants did you have at your New Year's party? (day #0)

at day 0, $t = 0$, $n = ?$ (this is the b-value)

$n = -28.5(0) + 9841 =$ 9841 ants

c) When will the entire ant colony be dead?

$t = ?$ when $n = 0$

$0 = -28.5t + 9841$

$28.5t = 9841$

$t \approx 345.3$

by the 346th day

d) The ant colony fair requires a minimum population of 1000. When will your ant colony become ineligible to defend its 1st prize at the fair?

$t = ?$ when $n = 1000$

$1000 = -28.5t + 9841$

$\frac{-8841}{-28.5} = \frac{-28.5t}{-28.5}$

$310.2 \approx t$

$\Rightarrow$ we'll be ineligible for fair on the 311th day