$m = \frac{y_2 - y_1}{x_2 - x_1}$ $y - y_1 = m(x - x_1)$ key

Notes: Linear Applications

1) You pull out the plug from the bathtub. After 40 seconds, there are 14 gallons of water left in the tub. One minute after you pull the plug, there are 10 gallons left. Assume that the number of gallons varies linearly with the time since the plug was pulled.

a) What's the independent variable?

x = seconds since plug pulled

b) What's the dependent variable?

y = # gallons left in tub

c) Write an equation for this linear function.

(40, 14) (60, 10)

$m = \frac{10 - 14}{60 - 40} = \frac{-4}{20} = -\frac{1}{5} = -0.2 \frac{\text{gallons}}{\text{second}}$

$y - 10 = -\frac{1}{5}(x - 60)$

$y - 10 = -\frac{1}{5}x + 12 + 10$

$\boxed{y = -\frac{1}{5}x + 22}$

d) How many gallons were left 20 seconds after you pulled the plug?

$y = -\frac{1}{5}x + 22$

$y = -\frac{1}{5}(20) + 22 = -4 + 22 = \boxed{18 \text{ gallons}}$

e) What is the y-intercept and what does it represent in this problem?

$y = -\frac{1}{5}x + 22$

22 gallons when time is 0. Gallons tub holds when full.

f) What is the rate of change and what does it represent?

$-0.2 \frac{\text{gallons}}{\text{second}}$

.2 gallons draining out of tub every second

2) The number of dollars per month it costs you to own a car is related linearly with the number of miles you drive it per month. *Time* magazine found that your monthly car costs were $366 if you drove 300 miles per month, and that your monthly car costs were $510 if you drove 1500 miles per month.

a) What's the independent variable?

x = # miles drive each month

b) What's the dependent variable?

y = $ per month to own a car

c) Write an equation for this linear function.

(300, 366) (1500, 510)

$m = \frac{510 - 366}{1500 - 300} = .12 \frac{\$}{\text{mile}}$

$y - 366 = (.12)(x - 300)$

$y - 366 = .12x - 36$

$+366 \qquad +366$

$\boxed{y = .12x + 330}$

d) What is the y-intercept and what does it represent in this problem?

330

Your car costs $330/month if you drive 0 miles.

e) What is the rate of change and what does it represent?

$0.12 per mile

Each mile you drive, your car costs an additional $0.12.

f) If your monthly car costs were $1000, how many miles did you drive that month?

$1000 = .12x + 330$

$-330 \qquad -330$

$670 = .12x$

$x = \boxed{5583.3 \text{ miles}}$

3) Based on information in *Deep River Jim's Wilderness Trailbook*, the rate at which a cricket chirps is a linear function of temperature. The crickets chirp 76 times per minute when it's 59° F, and at 65° F they make 100 chirps per minute.

°F # chirps

(59, 76)

(65, 100)

a) What's the independent variable? x = temperature (°F)

b) What's the dependent variable? y = # chirps / minute

c) Write an equation for this linear function.

$m = \frac{100-76}{65-59}$

$= 4 \frac{\text{chirps a minute}}{°F}$

$y - 76 = 4(x-59) = 4x - 236$

$+76 \qquad +76$

$y = 4x - 160$

d) What's the chirping rate at 90° F?

$y = 4(90) - 160 =$ 200 chirps a minute

e) How warm is it if you count 120 chirps?

$120 = 4(x) - 160$

$+160 \qquad +160$

280

$\frac{280}{4} = \frac{4x}{4}$

$x = 70$ °F

f) What would be a reasonable domain for this problem?

Values of x ?

Values of temperature

When is it too cold / hot for crickets?

40°F - 100°F ?

0 chirps

$0 = 4x - 160$

$160 = 4x$

$40 = x$