Section 4.4 Linear Functions

Part 1 – Finding X and Y Intercepts of an Equation

What is an *x*-intercept?

where the graph crosses the x-axis

What is a *y*-intercept?

where the graph crosses the y-axis

How do you find an *x*-intercept?

Set $y = 0$ and solve

How do you find a *y*-intercept?
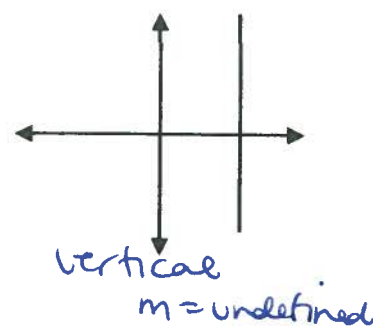
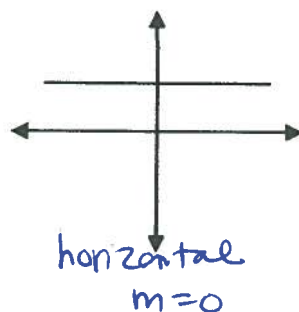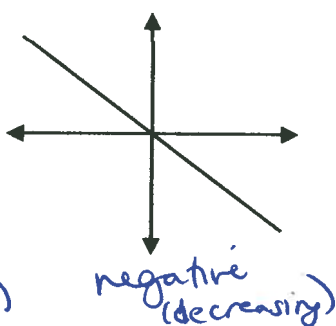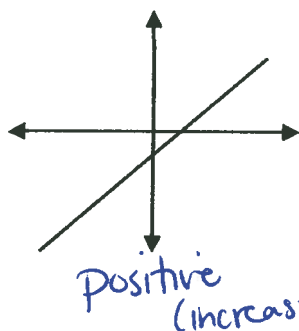Set $x = 0$ and solve

Part 1 – Slope (Gradient) of a Line

Slope Formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Find the slope of the line passing through the points (-2, 0) and (3, 1).

$$m = \left(\frac{1-0}{3-(-2)}\right) = \frac{1}{5} = m$$

Classification of slopes:

positive (increasing)

negative (decreasing)

horizontal $m = 0$

vertical $m = $ undefined

Graphing a Linear Equation in General Form
(y = mx + c) * We call it Slope Intercept Form**
Start with *y*-intercept; Use slope to find next point

Graphing a Linear Equation in Standard Form
(AX +BY + D = 0)
Find and plot the *x* and *y*-intercepts
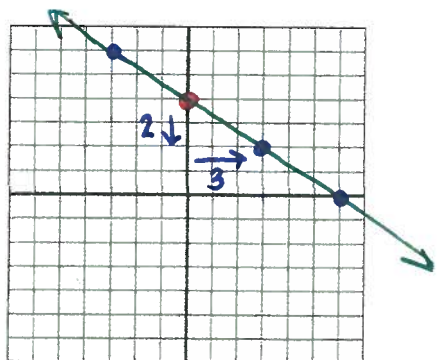
Examples – Graph each line and state the slope.

1. $y = \frac{-2}{3}x + 4$

$m = \frac{-2}{3}$

$\frac{down\ 2}{right\ 3}$

y-int = 4
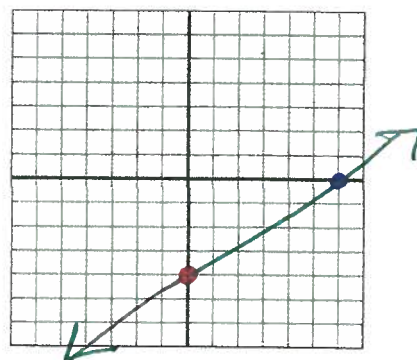

2. $2x - 3y = 12$

x-int
$2x - 3(0) = 12$
$2x = 12$
$x = 6$

y-int
$2(0) - 3y = 12$
$-3y = 12$
$y = -4$

Part 2 – Writing Equations of Lines

When writing the equation of a line you need at least ___2 points___ or ___1 point + slope___

Point-Slope Form: $y - y_1 = m(x - x_1)$ ⟶ not in formula booklet

Examples:

a) Find the equation of the line that passes through the point (4,-3) and has a slope of –2.

$$y - (-3) = -2(x - 4)$$
$$y + 3 = -2x + 8$$
$$\boxed{y = -2x + 5}$$

b) Find the equation of the line that passes through the points (-2,5) & (3,1).

$$m = \frac{1 - 5}{3 - (-2)} = \frac{-4}{5}$$

$$y - 1 = \frac{-4}{5}(x - 3)$$

$$y - 1 = \frac{-4}{5}x + \frac{12}{5}$$

$$y = \frac{-4}{5}x + \frac{12}{5} + \frac{5}{5}$$

$$\boxed{y = \frac{-4}{5}x + \frac{17}{5}}$$

Section 4.5 Linear Models

Example: A yacht has tanks of diesel fuel that must be filled before it heads out to sea. The tanks contain 500 gallons of fuel when the yacht arrives at the refueling dock. Diesel is pumped into the tank at 40 gallons a minute.

a) Find a function d giving the total volume of diesel in the yacht's tank after t minutes of pumping fuel.

500 gallons at start   pump 40 gallons a min $y = mx + c$
$$C = 500$$
$$m = 40 gal/1 min = 40$$
$$d = mt + c$$
$$\boxed{d = 40t + 500}$$

b) Find $d(30)$. What does that value represent?

$$d = 40(30) + 500 = 1700 \text{ gallons}$$
Amount in tank after 30 min

c) Find the time it takes to fill the tanks if the tanks have a capacity of 2440 gallons.

$$2440 = 40t + 500$$
$$1940 = 40t$$
$$t = 48.5 \text{ minutes}$$

d) What is the domain of the function?

The tanks can only hold 2440 gallons. This happens at 48.5 min
$$0 \leq t \leq 48.5 \text{ min}$$

e) What is the range of the function?

The least the tank holds is 500. The most is 2440
$$500 \leq d \leq 2440 \text{ gallons}$$

Example: The life expectancy E of a female in 1970 was 74.6 and in 2000 was 79.7.

a) Write a linear equation E(t) where t is the number of years since 1960.

$t = x$ -value $=$ years since 1960   (10, 74.6) (40 , 79.7)

$E(t) = y$ -value $=$ age

                                            ↑   ↑

                                         1970   2000

b) Then use the equation to predict the life expectancy of a female in 2020.

$$m = \frac{79.7 - 74.6}{40 - 10} = \frac{5.1}{30} = .17$$

$$y - y_1 = m(x - x_1)$$

$$y - 74.6 = .17(x - 10)$$

$$y - 74.6 = .17x - 1.7$$

$$y = .17x + 72.9$$

ⓐ $\boxed{E(t) = .17t + 72.9}$

ⓑ $2020 = 60$ years since 1960

$$E(60) = .17(60) + 72.9$$

$$= \boxed{83.1 \text{ yrs old}}$$