# Mini-Lecture 2.4

Linear Functions and Models

**Learning Objectives:**

1. Graph linear functions.
2. Find the zero of a linear function.
3. Build linear models from verbal descriptions
4. Build linear models from data.

**Preparing for Linear Functions and Models:**

*i)* Solve for $x$: $\frac{2}{3}x + 4 = 0$.

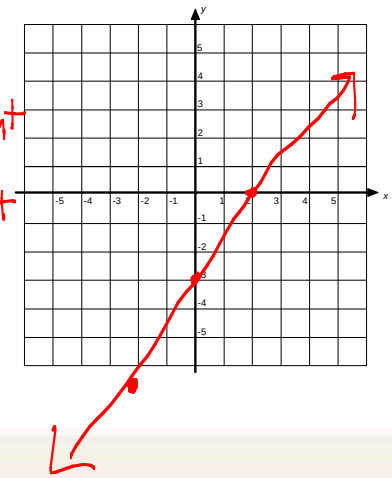
$\frac{3}{2} \cdot \frac{2}{3}x = -4 \cdot \frac{3}{2}$

$x = -\frac{12}{2} = -6$

*ii)* Graph using the point-plotting method:

$3x - 2y = 6$.

| x | y | |
|---|---|---|
| 0 | -3 | y-int |
| 2 | 0 | x-int |
| -2 | -6 | |



**Examples:**

**DEFINITION**

A **linear function** is a function of the form

$$f(x) = mx + b$$

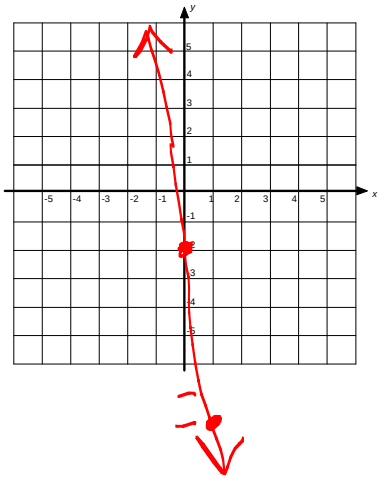
where $m$ and $b$ are real numbers. The graph of a linear function is called a **line.**

1. Graph each linear function.

a) $f(x) = -6x - 2$

$m = \frac{-6}{1}$

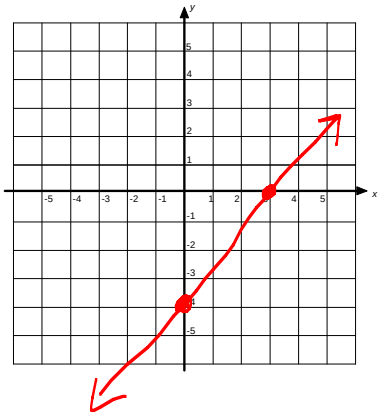
$b = -2$



b) $f(x) = \frac{4}{3}x - 4$

$m = \frac{4}{3}$

$b = -4$



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$y=0$ $(H(x)=0)$

2. Find the zero of $H(x) = -\frac{3}{2}x + 6$.

$0 = -\frac{3}{2}x + 6$

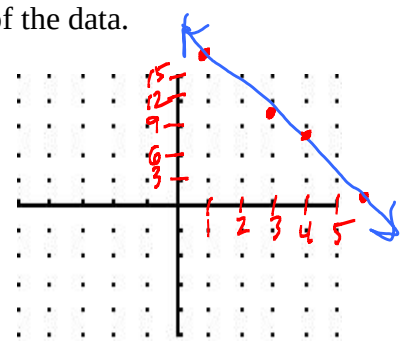
$\frac{2}{3} \cdot \frac{3}{2}x = 6 \cdot \frac{2}{3}$

$x = \frac{12}{3} = 4$

3. Use the set of data points below.

| $x$ | 1 | 4 | 3 | 6 |
|---|---|---|---|---|
| $y$ | 18 | 8 | 10 | 2 |

a) Draw a scatter diagram of the data.




b) Select two points from the scatter diagram and find the equation of line containing the two points selected.

$(1, 18)$ $(6, 2)$

$m = \frac{2-18}{6-1} = \frac{-16}{5}$

$y - 2 = \frac{-16}{5}(x - 6)$

$y - 2 = -\frac{16}{5}x + \frac{96}{5} + 2$

$+2$

$y = -\frac{16}{5}x + \frac{106}{5}$

c) Graph the line found in part b) on the scatter diagram.

4. **Perimeter of a Rectangle** In a given rectangle, the length is 3 ft less than twice the width. If $x$ represents the width of the rectangle, the perimeter can be calculated by the function: $P(x) = 2x + 2(2x - 3)$.

a) What is the implied domain of the function?

$(0, \infty)$

b) What are the dependent and independent variables?

range domain

indep: $x$

dep: $P(x)$

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c) What is the perimeter of a rectangle whose width is 12 ft?

$P(12) = 2(12) + 2(2(12) - 3)$

$P(12) = 24 + 2(21)$

$P(12) = 24 + 42 = 66\text{ft}$

d) What is the width of a rectangle whose perimeter is 84 ft?

$84 = 2x + 2(2x - 3)$

$84 = 2x + 4x - 6$

$84 = 6x - 6$

$90 = 6x$

$x = 15\text{ ft}$