Key Features of Linear Functions

A **linear function** is a function that can be written in the standard form $Ax + By = C$ where A, B, and C are integers. Always make sure a GCF can't be divided out of all terms. When a linear function is written in standard form, *y* is a function of *x*.

The graph of a linear function is a straight line. The graph has a *y*-intercept where the graph crosses the *y*-axis and/or an *x*-intercept where the graph crosses the *x*-axis.

- The **y-intercept** can be found when $x = 0$.
- The **x-intercept (zero)** can be found when $y = 0$.

Important!!

EXAMPLE 1 Interpret Linear Models

EXPLORE Ana is flying a model airplane on its final descent. The table shows the function relating the height of the plane above the ground and the time that the plane has been descending.

Time(s)	Height (ft)
x	*y*
0	48
2	36
4	24
6	12
8	0

yint.

xint.

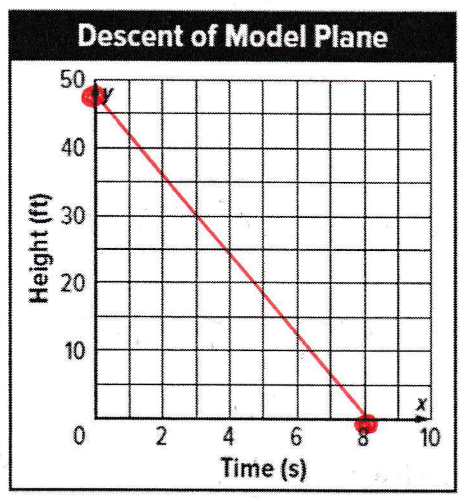
a. USE STRUCTURE Find the *x*- and *y*-intercepts of the graph of the function. Explain how you found each intercept. TEKS 3.C, 1.F, 1.G

x-intercept: (8,0)

y-intercept: (0,48)

b. USE A MODEL Plot the *x*-intercept. Interpret what it represents. TEKS 3.C, 1.G

After 8 seconds, its height is 0.



c. USE A MODEL Plot the *y*-intercept. Interpret what it represents. TEKS 3.C, 1.G

At 0 seconds, the plane is at 48 ft.

d. USE STRUCTURE Does plotting the *x*- and *y*-intercepts give you sufficient information to graph the function? Justify your answer. If it is yes, then complete the graph. TEKS 3.C, 1.G

Yes, you need at least two points.

HOY VUX

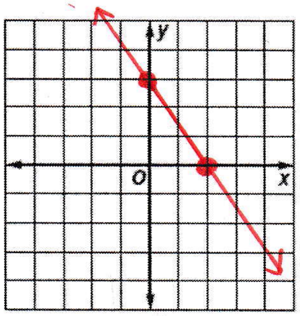
horizontal — slope is 0 — $y = \#$

vertical — undefined — $x = \#$

EXAMPLE 2 Graph Linear Functions

USE STRUCTURE Graph each linear function. Identify the intercepts. TEKS 3.C, 1.D, 1.E

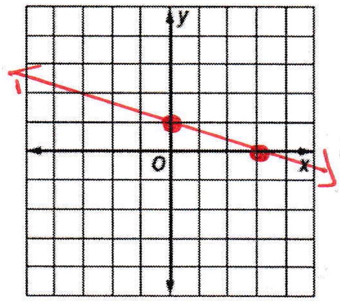
a. $3x + 2y = 6$



xint: $(y=0)$
$3x + 2(0) = 6$
$3x + 0 = 6$
$\frac{\cancel{3}x}{\cancel{3}} = \frac{6}{3}$
$x = 2$
point $(2,0)$

yint: $(x=0)$
$3(0) + 2y = 6$
$0 + 2y = 6$
$\frac{\cancel{2}y}{\cancel{2}} = \frac{6}{2}$
$y = 3$
point $(0,3)$

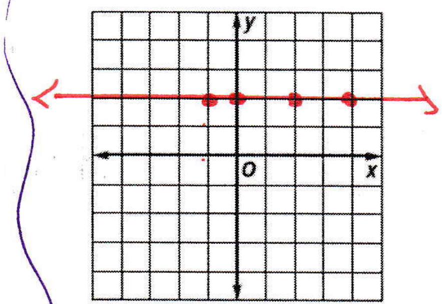
b. $x + 3y = 3$



xint $(y=0)$
$x + 3(0) = 3$
$x + 0 = 3$
$x = 3$
point $(3, 0)$

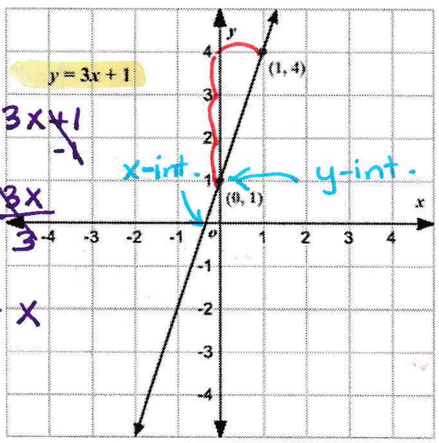
yint $(x=0)$
$0 + 3y = 3$
$\frac{\cancel{3}y}{\cancel{3}} = \frac{3}{3}$
$y = 1$
point $(0, 1)$

c. $y = 2$



horizontal line
$(-1, 2)$ $(0, 2)$
$(2, 2)$ $(4, 2)$
y of the point is always 2.

Identify the Following Key Features from The linear Functions Below



$0 = 3x + 1$
$-1 \quad -1$
$\frac{-1}{3} = \frac{\cancel{3}x}{\cancel{3}}$
$\frac{-1}{3} = x$

positive slope

Slope: $\frac{rise}{run} = \frac{3}{1} = \boxed{3}$

$(x=0)$ y-intercept: $(0, 1)$

$(y=0)$ Zero: x-int: $(-\frac{1}{3}, 0)$

Domain: $-\infty < x < \infty$

Range: $-\infty < y < \infty$

x	$f(x)$
0	- 4
1	- 2
2 (x_1)	0 (y_1)
3 (x_2)	2 (y_2)
4	4

yint.

xint.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-0}{3-2} = \frac{2}{1}$

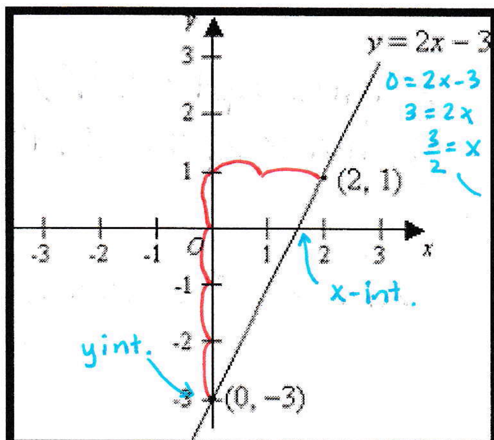
Slope: $m = 2$

y-intercept: $(0, -4)$

Zero: (xint) $(2, 0)$

Domain: $\{x \mid 0, 1, 2, 3, 4\}$

Range: $\{y \mid -4, -2, 0, 2, 4\}$



$0 = 2x - 3$
$3 = 2x$
$\frac{3}{2} = x$ or 1.5

positive slope

Slope: $m = \frac{rise}{run} = \frac{4}{2}$ $\boxed{m = 2}$

y-intercept: $(0, -3)$

Zero: $(1.5, 0)$

Domain: $-\infty < x < \infty$

Range: $-\infty < y < \infty$