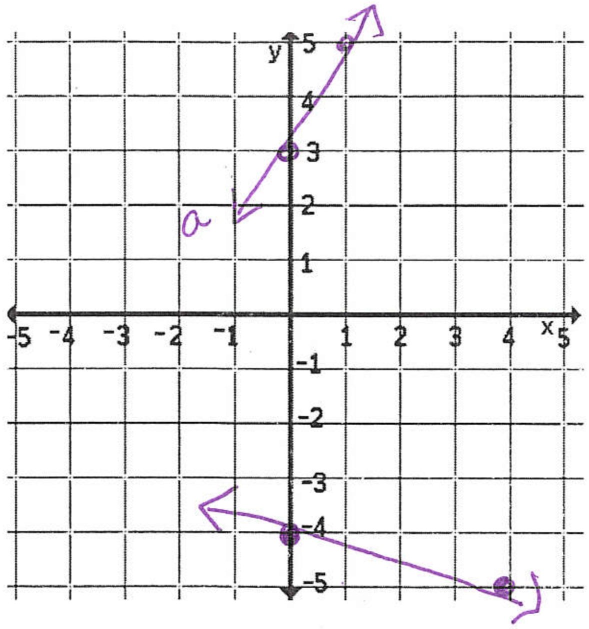
A4A lab.

4.1 Graphing Equation in Slope-Intercept Form

- Slope-Intercept Form

$y = mx + b$

slope (steepness) — y-intercept



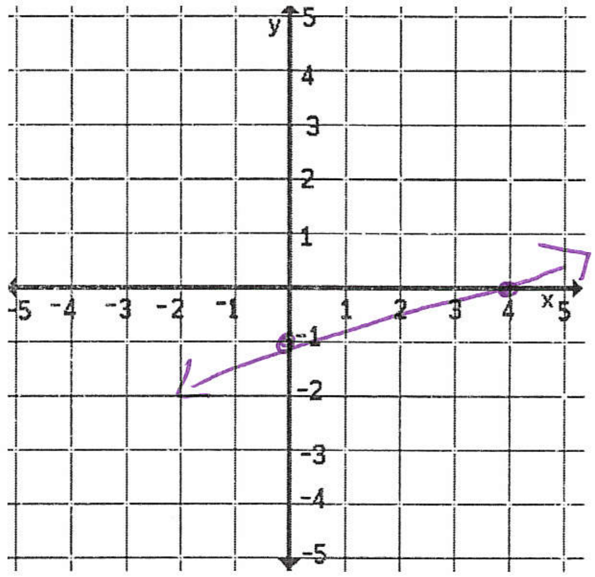
a) $y = 2x + 3$

b) $y = -\frac{1}{4}x - 4$

Example – No Calculator

Write an equation in slope-intercept form of the line with a slope of ¼ and a y-intercept of -1. Then graph the equation.

$y = \frac{1}{4}x - 1$



Examples – No Calculator

Graph the following equations.

a) $5x + 4y = 8$

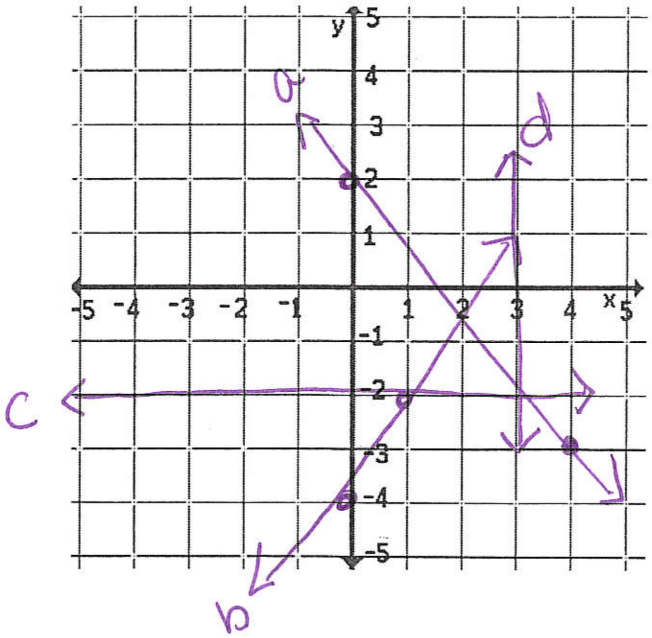
$\frac{4y}{4} = \frac{8 - 5x}{4}$ $\quad y = 2 - \frac{5}{4}x$

b) $2x - y = 4$

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

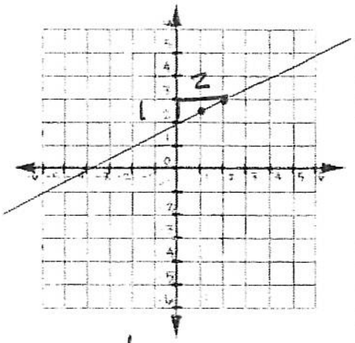
c) $y = -2$ horiz.

d) $x = 3$ vert.

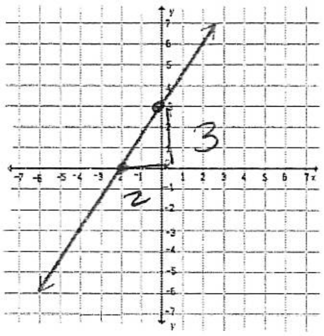


Examples

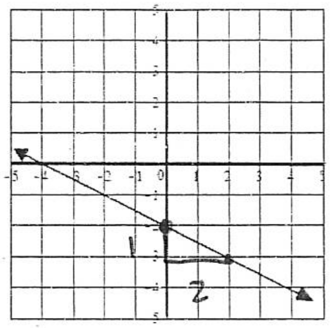
Write the equation for the following graphs in slope-intercept form.



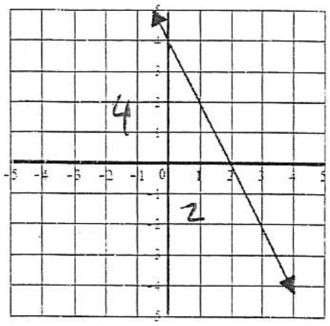
$y = \frac{1}{2}x + 2$



$y = \frac{3}{2}x + 3$



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



$y = 2x + 4$

Example

The ideal maximum heart rate for a 25 year old exercising to burn fat is 117 beats per minute. For every five years older than 25, that ideal rate drops three beats per minute.

(25, 117)
(30, 114)

a) Write a linear equation to find the ideal maximum heart rate for anyone over 25 who is exercising to burn fat.

$\frac{y-y}{x-x}$ $\frac{117-114}{25-30} = \frac{3}{-5}$

$y = -\frac{3}{5}x + b$

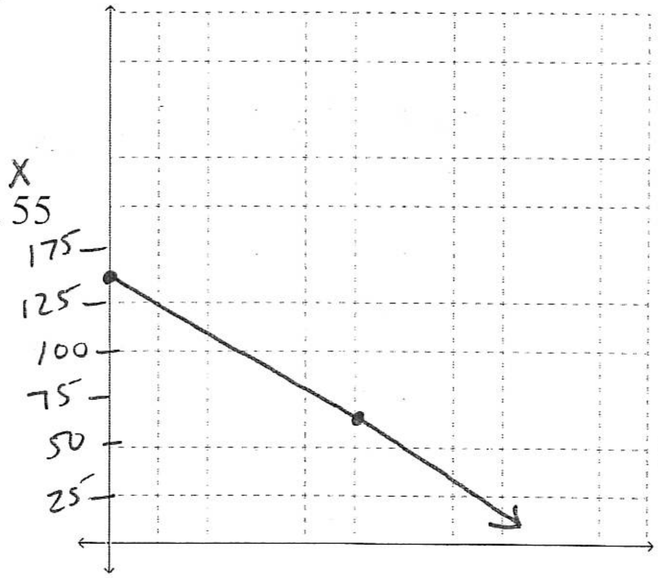
117   25

$117 = {}^-15 + b$

$132 = b$

$y = -\frac{3}{5}x + 132$

b) Graph the equation.



c) Find the ideal maximum heart rate for a 55 year old person exercising to burn fat.

x

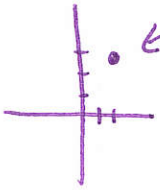
$-\frac{3}{5}x + 132$

55

99

4.2 Writing Equations in Slope-Intercept Form using Point-Slope Form

Write an equation for a line through the point (2, 3) with a slope of 7.



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

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

- Point-Slope Form

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

replace w/ #s

Slope 5
through (2, 6)

Examples

Write an equation in slope-intercept form for a line that meets the following conditions:

a) Passes through (2, -3) with a slope of ½

x y m

$$y-y=m(x-x)$$
$$y+3=\tfrac{1}{2}(x-2)$$
$$y+3=\tfrac{1}{2}x-1$$
$$-3 \qquad -3$$
$$y=\tfrac{1}{2}x-4$$

Check to see if (2, -3) is in table

b) Passes through (4, 5) with a slope of 6

$$y-5=6(x-4)$$
$$y-5=6x-24$$
$$y=6x-19$$

c) Passes through the points (-3, -4) and (-2, -8)

Slope

$$\frac{-8--4}{-2--3}$$

$$\frac{-4}{1}$$

$$=-4$$

$$y+4=-4(x+3)$$

$$y+4=-4x-12$$

$$y=-4x-16$$

d) Passes through the points (6, -2) and (3, 4)

$$\frac{4--2}{3-6}$$

$$\frac{6}{-3}$$

$$-2$$

$$y+2=-2(x-6)$$

$$y+2=-2x+12$$

$$y=-2x+10$$

Examples

During one year Malik's cost for self-serve regular gasoline was \$3.20 on the first of June and \$3.42 on the first of July. Write a linear equation to predict Malik's cost of gasoline the first of any month during the year, using 1 to represent January.

6

$(6, 3.20)$

$(7, 3.42)$

$$\frac{3.42-3.20}{7-6}$$

$$\frac{.22}{1}$$

$$=.22$$

$$y-3.2=.22(x-6)$$

$$y-3.2=.22x-1.32$$

$$y=.22x+1.88$$

On average, Malik uses 25 gallons of gas per month. He budgeted \$100 for gas in October. Use the prediction equation above to determine if Malik budgeted enough.

$$y=.22x+1.88$$

↑

10

4.08 per gallon

x 25gal

\$102 No, \$2 short

4.3 Point-Slope Form Continued

When would you use point-slope (PS) versus slope-intercept (SI) form?

only when have y-intercept (0, #)

1) Slope of 2, through the point (2, 5)	PS	4) Slope of -3/4 through the point (7, 0)	PS
2) Slope of 6 through the point (0, 3)	SI	5) Through the points (2, 3) and (5, 9)	PS
3) Slope of -2 with a y-intercept of 4	SI	6) Through the point (4, 2) with a slope of 5	PS

Recall we have three different forms we can use to write linear equations:

Slope-Intercept	Point-Slope	Standard
$y=mx+b$	$y-\underline{y}=\underline{m}(x-\underline{x})$ #S	$Ax+By=C$

Examples

Re-write the given equation for a line in the requested form.

1) $y=\frac{3}{4}x-5$ in standard form $Ax+By=C$

$\left(-\frac{3}{4}x+y=-5\right)4$ $\boxed{-3x+4y=-20}$

2) $y-5=2(x-3)$ in slope-intercept form $y=mx+b$

$y-5=2x-6$

$\boxed{y=2x-1}$

3) $y + 3 = \frac{3}{2}(x + 1)$ in slope-intercept form $y=mx+b$

$y+3 = \frac{3}{2}x + 1.5$

$y = \frac{3}{2}x - 1.5$

4) *through the point* $(5, 3)$ m=7 in point-slope form $y - y = m(x - x)$

$y-3=7(x-5)$

5) $y + 7 = -\frac{3}{2}(x + 2)$ in standard form $Ax+By=C$

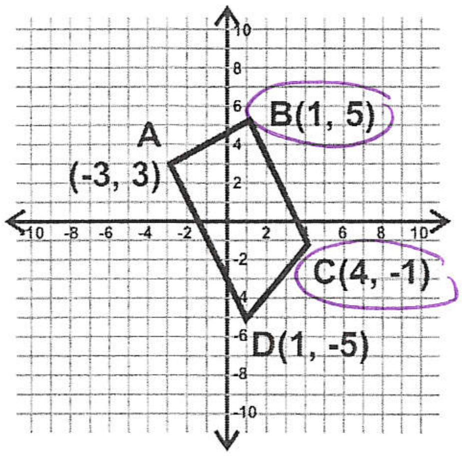
$y+7 = -\frac{3}{2}x - 3$

$(\frac{3}{2}x + y = -10)2$

$3x+2y=-20$

Example

Use the trapezoid pictured at the right.



a) Write an equation in point-slope form for the line containing the side BC.

Slope

$\frac{-1-5}{4-1}$

$\frac{-6}{3} = -2$

$y-5=-2(x-1)$

$y-5 = -2x+2$

$y=-2x+7$

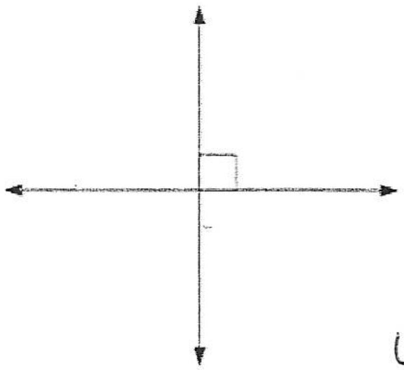
b) Write an equation in standard form for the line.

$2x+y=7$

4.4 Parallel and Perpendicular Lines

Parallel Lines

Same Slope



Perpendicular Lines

opp. recip.

$y = 3x$

$y = -\frac{1}{3}x$

Orig.

1 $y = 8x - 1$ $y = 8x + 3$ $y = -\frac{1}{8}x - 4$

2 $y = \frac{2}{5}x$ $y = \frac{2}{5}x - 1$ $y = -\frac{5}{2}x$

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

Examples – No Calculator

Determine whether the following lines are parallel, perpendicular or neither.

1) $y = 2x - 1$ $y = 2x + 3$ Parallel

2) $y = -\frac{1}{3}x + 5$ $y = 3x - 1$ Perp

3) $y = \frac{2}{5}x - 4$ $y = \frac{5}{2}x - 9$ Neither

4) $y = 7x - 1$ $y = \frac{1}{7}x - 4$ Neither

5) $y = 5$ $y = 2$ Par

6) $y = 7$ $x = 8$ Perp.

7) $2x - 8y = -24$ $\quad$ $4x + y = -2$

$\frac{-8y}{-8} = \frac{-24 - 2x}{-8}$

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

$\boxed{y = -2 - 4x}$

Perp.

8) 2x + 7y = -35 $\quad$ 4x + 14y = 24

$\frac{7y}{7} = \frac{-35 - 2x}{7}$ $\quad$ $\frac{14y}{14} = \frac{24 - 4x}{14}$

$y = -5 - \frac{2}{7}x$ $\quad$ $y = \frac{12}{7} - \frac{2}{7}x$

Parallel

Example

Write an equation in slope-intercept form for the line that passes through (4, -2) and is parallel to the graph of $y = \frac{1}{2}x - 7$.

same Slope

$y + 2 = \frac{1}{2}(x - 4)$

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

$\boxed{y = \frac{1}{2}x - 4}$

Write an equation in slope-intercept form for the line that passes through (4, 6) and is perpendicular to the graph of $y = \frac{1}{3}x - 4$.

-3

$y - 6 = -3(x - 4)$

$y - 6 = -3x + 12$

$y = -3x + 18$

Examples

Determine whether the following lines are parallel or perpendicular and explain.

1 $\quad$ 2 $\quad$ 3

$y = \frac{2}{3}x + 3, y = \frac{3}{2}x, 2x - 3y = 8$

$-3y = 8 - 2x$

$y = -\frac{8}{3} + \frac{2}{3}x$

1 & 3 Parallel, Same Slope

2 No relation

1 $\quad$ 2 $\quad$ 3

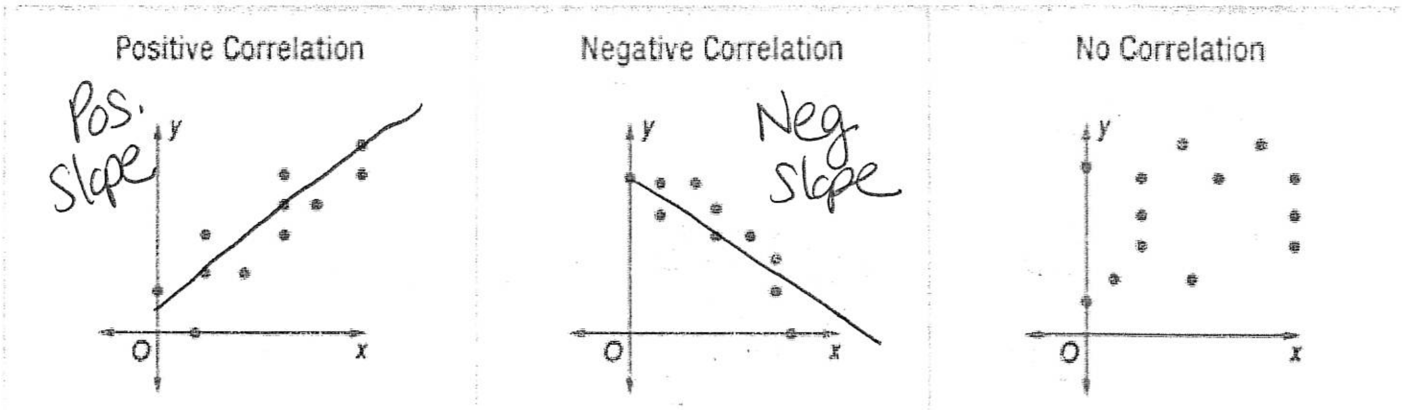
$y = 4x, x + 4y = 12, 4x + y = 1$

$4y = 12 - x$ $\quad$ $y = 1 - 4x$

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

1 & 2 perp - opp & flipped

4.5 Scatterplots and Lines of Fit

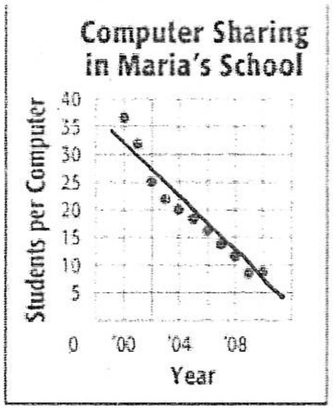


- Scatterplot

- Line of Best Fit – line that best matches trend of data. Useful for predictions.
  – most real-life data not perfectly linear.

Example

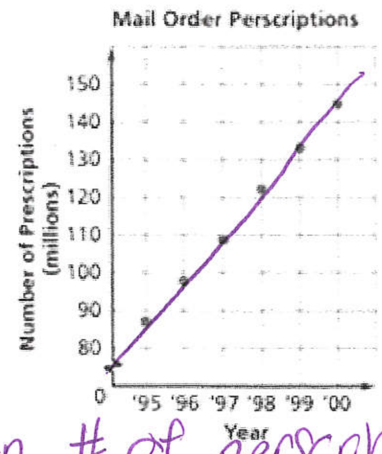
TECHNOLOGY The graph shows the average number of students per computer in Maria's school. Determine whether the graph shows a *positive correlation*, a *negative correlation*, or *no correlation*. If there is a positive or negative correlation, describe its meaning in the situation.



Negative correlation, as time goes on, less Students per computer.

1-1

The graph shows the number of mail-order prescriptions. Determine whether the graph shows a *positive correlation*, a *negative correlation*, or *no correlation*. If there is a positive or negative correlation, describe it.



Pos, as time goes on, # of perscriptions goes up.

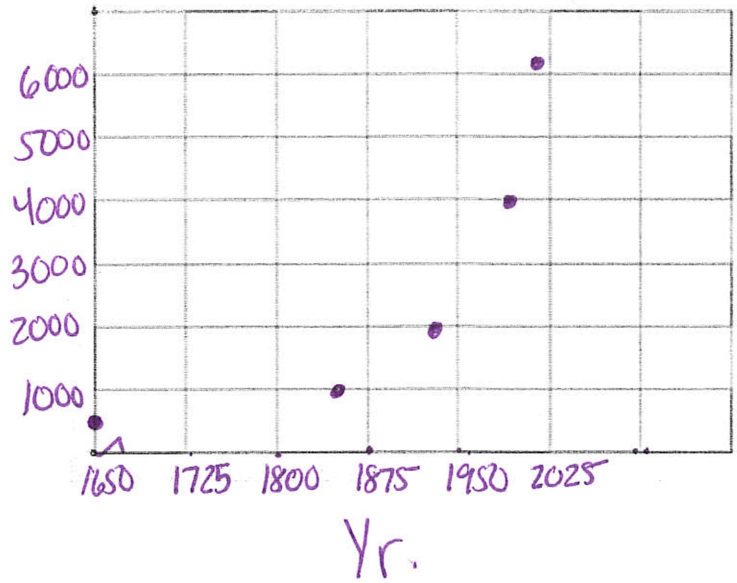
Example

POPULATION The table shows the world population growing at a rapid rate. Identify the independent and dependent variables. Make a scatter plot and determine what relationship, if any, exists in the data.

Year	Populations (millions)
1650	500
1850	1000
1930	2000
1975	4000
2004	6400

Indep Dep.

Positive



Use the equation to predict the world's population in 2025.

$\frac{6400-500}{2004-1650}$ $\frac{5900}{354}$ $16.\bar{6}$ $y-500=\frac{50}{3}(x-1650)$ 2025

$\boxed{6750}$

① Stat Edit

② Stat → Calc #4

4.6 Regression Lines

- Regression Line –

  Line of Best Fit

- Correlation Coefficient -- Shows how accurate eqn is.

  $|r| = 1$

Example

The table shows Ariana's hourly earnings for 2001-2007. Use a graphing calculator to determine the best-fit line for that data. Also find the correlation coefficient. Let x be the number of years since 2000.

	Year	Cost
1	2001	$10.00
2	2002	$10.50
3	2003	$11.00
4	2004	$13.00
5	2005	$15.00
6	2006	$15.75
7	2007	$16.50

$y = 1.21x + 8.25$

Example

The table below shows the points earned by the top ten bowlers in a tournament. Estimate how many points the 15th ranked bowler earned.

Rank	Score	Rank	Score
1	210	6	147
2	197	7	144
3	164	8	142
4	158	9	134
5	151	10	132

$y = -7.87x + 201.2$

Lab

4.7 Inverse Linear Functions

- Inverse Relation

$f(x)=1.50x$ $y=1.50x$

cost = 1.50 x # candy bars

$f^{-1}(x)=\frac{x}{1.50}$ $x=1.50y$

(Inverse) $\frac{x}{1.50}=y$

candy bar = $\frac{\text{cost}}{1.50}$

~~cost~~

x & y switch positions

Example – No Calculator

Find the inverse of each relation.

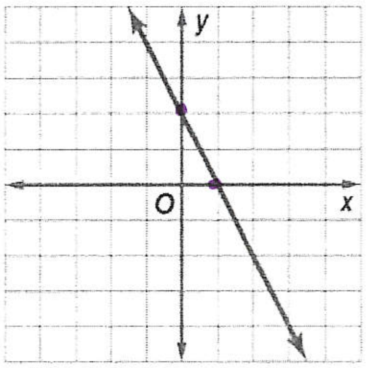
a) { (-3, 26), (2, 11), (6, -1), (-1, 20)} {(26, -3) (11, 2) (-1, 6) (20, -1)}

b)

x	y
-4	-3
-2	0
1	4.5
5	10.5

-3, -4
0, -2
4.5, 1
10.5, 5

c)

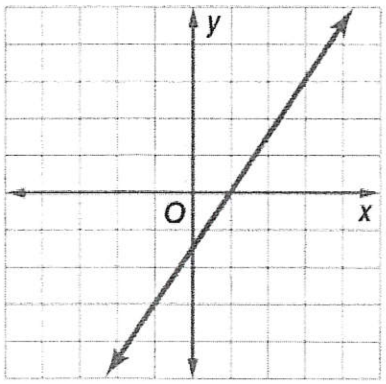


Now $y=-2x+2$

$x=-2y+2$

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

D)



Now y=

- Inverse Function –

Examples

Find the inverse of each function.

a) $f(x) = -3x + 27$

$x = -3y + 27$

$x - 27 = -3y$

$y = \frac{x-27}{-3}$

b) $f(x) = \frac{5}{4}x - 8$

$x = \frac{5}{4}y - 8$

$\frac{x+8}{5/4} = \frac{\frac{5}{4}y}{5/4}$

$y = \frac{4}{5}(x+8)$

c) $f(x) = 2x - 1$

$x = 2y - 1$

$\frac{x+1}{2} = \frac{2y}{2}$

$y = \frac{x}{2} + \frac{1}{2}$

Example

Carter sells paper supplies and makes a ~~vase~~ b ase salary of \$2200 each month. He also earns 5% commission on his total sales. His total earnings f(x) for a month in which he complied x dollars in total sales is f(x) = 2200 + 0.05x.

a) Find the inverse function. $x = 2200 + 0.05y$

$\frac{x - 2200}{.05} = \frac{.05y}{.05}$

$f^{-1}(x) = 20x - 44000$

b) What do x and $f^{-1}(x)$ represent in the context of the inverse function?

total earnings   dollars in sales

c) Find Carter's total sales for last month if his earnings for that month were $\underline{\$3450}$.
x

$20(3450) - 44000$ 25000