# ASSIGNMENT 4

DYLAN ZWICK'S MATH 1010 CLASS

## 2.5 Absolute Value Equations and Inequalities

Determine whether the value is a solution of the equation:

**2.5.1:** $|4x + 5| = 10$, $x = -3$

Not a Solution

**2.5.4:** $|\frac{1}{2}t + 4| = 8$, $t = 6$

Not a Solution

**2.5.2:** $|2x - 16| = 10$, $x = 3$

Solution

Transform the absolute value equation into two linear equations:

**2.5.5:** $|x - 10| = 17$

$x-10=17$ or $x-10=-17$

**2.5.8:** $|22k + 6| = 9$

$22k+6=9$ or $22k+6=-9$

**2.5.7:** $|4x + 1| = \frac{1}{2}$

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

Write the absolute value equations in standard form:

**2.5.9:** $|3x| + 7 = 8$

$|3x|=1$

**2.5.11:** $3|2x| - 1 = 5$

$|2x|=2$

*Date*: Due Wednesday, September 23th.

Solve the equations:

**2.5.13:** $|x| = 4$

$x = 4$ or $x = -4$

**2.5.16:** $|s| = 16$

$s = 16$ or $s = -16$

**2.5.17:** $|h| = 0$

$h = 0$

**2.5.18:** $|x| = -82$

No solution

**2.5.20:** $|\frac{1}{3}x| = 2$

$x = 6$ or $x = -6$

**2.5.21:** $|x + 1| = 5$

$x = 4$ or $x = -6$

**2.5.24:** $|\frac{7a+6}{4}| = 2$

$\frac{7a+6}{4} = 2$ $\quad a = \frac{2}{7}$

or $\frac{7a+6}{4} = -2$ $\quad a = -2$

**2.5.26:** $|3x - 2| = -5$

No solution

**2.5.27:** $|5x - 3| + 8 = 22$

$x = \frac{17}{5}$ or $x = -\frac{11}{5}$

**2.5.28:** $|5 - 2x| + 10 = 6$

No solution

**2.5.30:** $|\frac{x-2}{5}| + 4 = 4$

$x = 2$

**2.5.32:** $4|5x + 1| = 24$

$|5x+1| = 6$

$x = 1$ or $x = -\frac{7}{5}$

**2.5.34:** $2|4 - 3x| - 6 = -2$

$x = \frac{2}{3}$ or $x = 2$

**2.5.35:** $|x + 8| = |2x + 1|$

$x+8 = 2x+1$ or $x+8 = -(2x+1)$

$x = 7$ $\qquad$ $x = -3$

**2.5.37:** $|3x + 1| = |3x - 3|$

$3x+1 = 3x-3$ or $3x+1 = -(3x-3)$

No Solution $\qquad x = \frac{1}{3}$

The only solution is $x = \frac{1}{3}$

**2.5.40:** $3|2-3x| = |9x+21|$

$3(2-3x) = 9x+21 \quad x = -\frac{5}{6}$

or $3(2-3x) = -(9x+21)$ No Solution

The only solution is $x = -\frac{5}{6}$

Write an absolute value equation that represents the verbal statement:

**2.5.42:** The distance between $-3$ and $t$ is 5.

$|-3-t| = 5$

Determine whether the $x$-value is a solution of the equality:

**2.5.43:** $|x| < 3, x = 2$

Solution

**2.5.45:** $|x-7| \geq 3, x = 9$

Not a Solution

**2.5.46:** $|x-3| > 5, x = 16$

Solution

Transform the absolute value inequality into a double inequality or two separate inequalities:

**2.5.47:** $|y+5| < 3$

$-3 < y+5 < 3$

**2.5.50:** $|8-x| > 25$

$8-x > 25$ or $8-x < -25$

Solve the inequality:

**2.5.51:** $|y| < 4$

$-4 < y < 4$

**2.5.53:** $|x| \geq 6$

$x \geq 6$ or $x \leq -6$

**2.5.56:** $|4z| \leq 9$

$-\frac{9}{4} \leq z \leq \frac{9}{4}$

**2.5.59:** $|x+6| > 10$

$x+6 > 10$, $x > 4$ or $x+6 < -10$, $x < -16$

**2.5.62:** $|6t+15| \geq 30$

$6t+15 \geq 30$ or $6t+15 \leq -30$

$t \geq \frac{5}{2}$ $\quad t \leq -\frac{15}{2}$

**2.5.65:** $\frac{|y-16|}{4} < 30$

$-104 < y < 136$

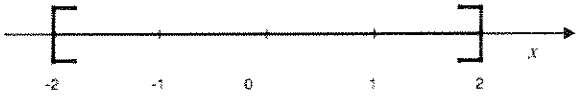
**2.5.69:** $\frac{|3x-2|}{4} + 5 \geq 5$

$-\infty < x < \infty$

**2.5.67:** $|0.2x - 3| < 4$

$-5 < x < 35$

**2.5.81:** Write an absolute value inequality that represents the interval:




$|x| \leq 2$

Write an absolute value inequality that represents the verbal statement:

**2.5.85:** The set of all real numbers $x$ whose distance from 0 is less than 3.

$|x| < 3$

**2.5.88:** The set of all real numbers $x$ for which the distance from 0 to 5 more than half of $x$ is less than 13.

$|\frac{1}{2}x + 5| < 13$

**2.5.89:** ***Speed Skating*** In the 2006 Winter Olympics, each skater in the 500-meter short track speed skating final had a time that satisfied the inequality $|t - 42.238| \leq 0.412$, where $t$ is the time in seconds. Sketch the graph of the solution of the inequality.What are the fastest and slowest times?

$|t - 42.238| \leq 0.412$

$41.826 \leq t \leq 42.65$

The fastest time is 41.826 seconds and the slowest time is 42.65 seconds.

**2.5.91:** ***Accuracy of Measurements*** In woodshop class, you must cut several pieces of wood to within3/16inch of the teacher's specifications. Let $(s - x)$ represent the difference between the specification $s$ and the measured length $x$ of a cut piece.

(a) Write an absolute value inequality that describes the values of $x$ that are within specifications.

$|5 - x| \leq \frac{3}{16}$

(b) The length of one piece of wood is specified to be $s = 5\frac{1}{8}$ inches. Describe the acceptable lengths for this piece.

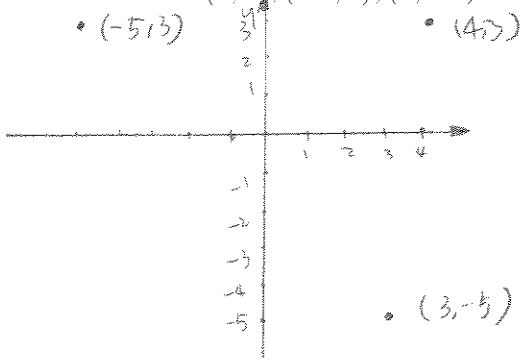
$|5\frac{1}{8} - x| \leq \frac{3}{16}$

$4\frac{15}{16} \leq x \leq 5\frac{5}{16}$

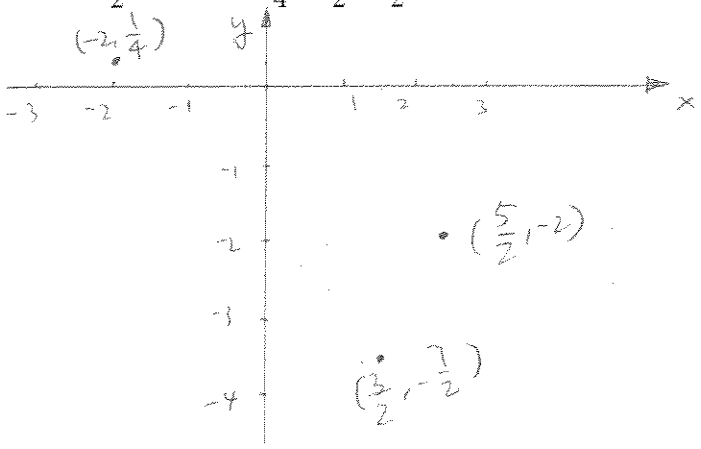
## 3.1 The Rectangular Coordinate System

Plot the points on a rectangular coordinate system:

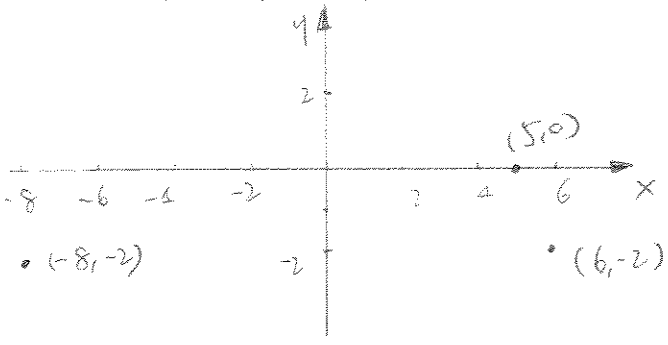
**3.1.1:** $(4,3), (-5,3), (3,-5)$



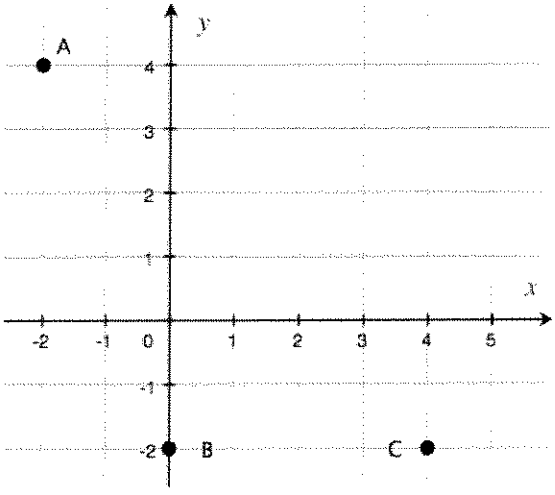

**3.1.5:** $(\frac{5}{2},-2), (-2,\frac{1}{4}), (\frac{3}{2},-\frac{7}{2})$




**3.1.3:** $(-8,-2), (6,-2), (5,0)$




**3.1.9:** Determine the coordinates of the points:

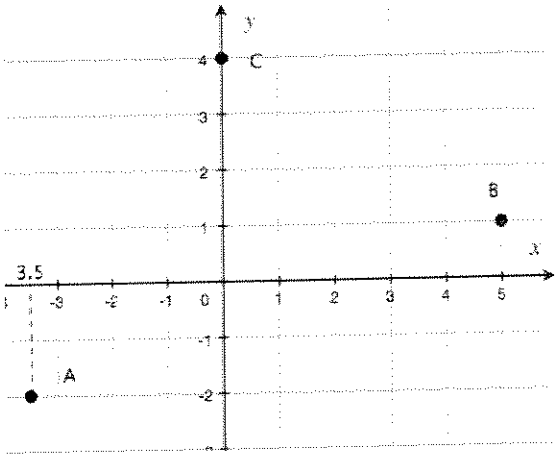



A (-2, 4)

B (0, -2)

C (4, -2)

**3.1.12:** Determine the coordinates of the points:



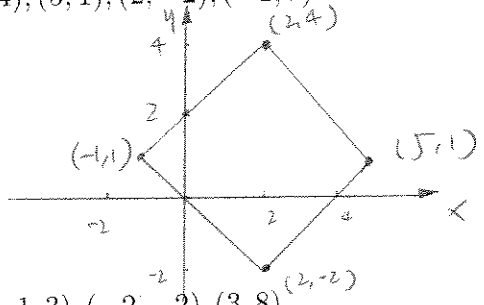

A $(-\frac{1}{2}, -2)$

B $(5, 1)$

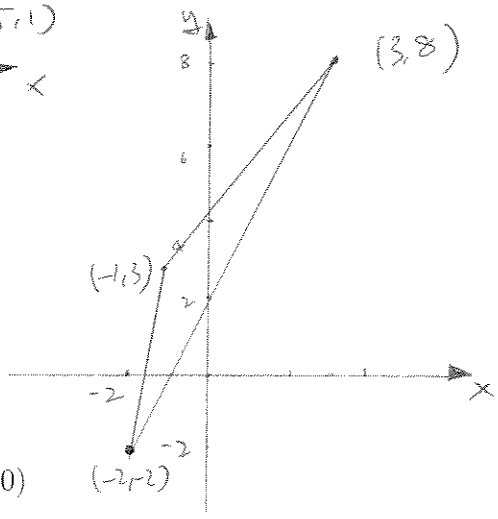
C $(0, 4)$

Plot the points and connect them with line segments to form the figure:

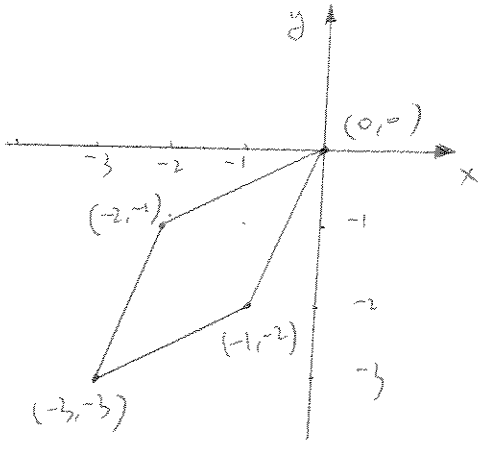
**3.1.13:** *Square*: $(2,4), (5,1), (2,-2), (-1,1)$




**3.1.16:** *Triangle*: $(-1,3), (-2,-2), (3,8)$




**3.1.20:** *Rhombus*: $(-3,-3), (-2,-1), (-1,-2), (0,0)$



Find the coordinates of the point:

**3.1.21:** The point is located one unit to the right of the $y$-axis and four units above the $x$-axis.

(1, 4)

**3.1.25:** The point is on the positive $x$-axis 10 units from the origin.

(10, 0)

**3.1.27:** The coordinates of the point are equal, and the point is located in the third quadrant eight units to the left of the $y$-axis.

(−8, −8)

Determine the quadrant in which the point is located without plotting it.($x$ and $y$ are real numbers)

**3.1.29:** $(-3, -5)$

III

**3.1.33:** $(-9.5, -12.13)$

III

**3.1.38:** $(x, -6)$

III or IV

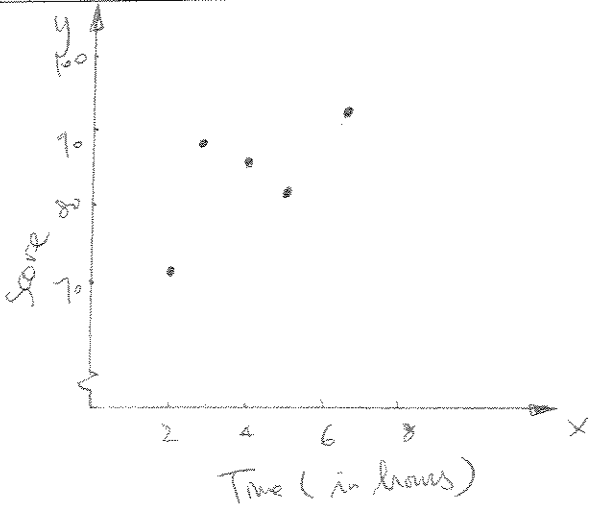
**3.1.41:** $(x, y), xy > 0$

I or III

Sketch a scatter plot of the points whose coordinates are shown in the table:

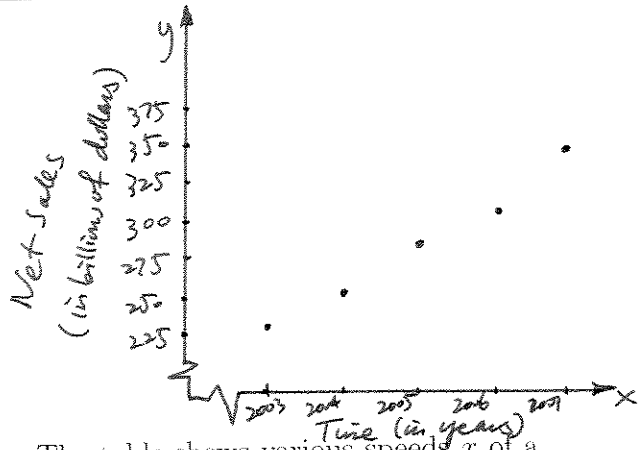
**3.1.43:** ***Exam Scores*** The table shows the time $x$ in hours invested in studying for five different algebra exams and the resulting score y.

| $x$ | 5 | 2 | 3 | 6.5 | 4 |
|---|---|---|---|---|---|
| $y$ | 81 | 71 | 88 | 92 | 86 |



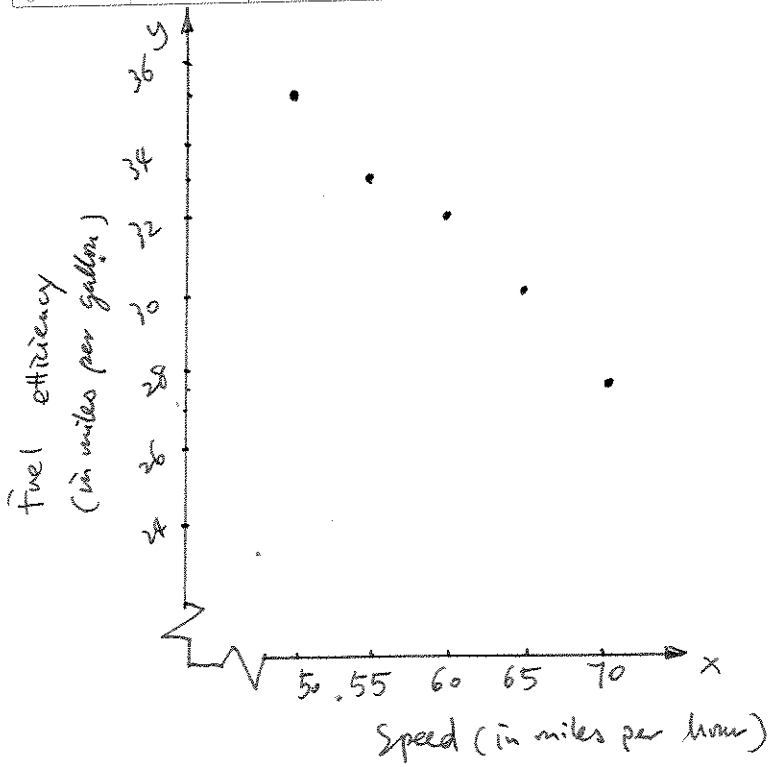
**3.1.44: *Net Sales*** The net sales$y$ (in billions of dollars) of Wal-Mart for the years 2003 through 2007 are shown in the table. The time in years is given by $x$. (Source: Wal-Mart 2007 Annual Report)

| $x$ | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|
| $y$ | 226.5 | 252.8 | 281.5 | 308.9 | 345.0 |

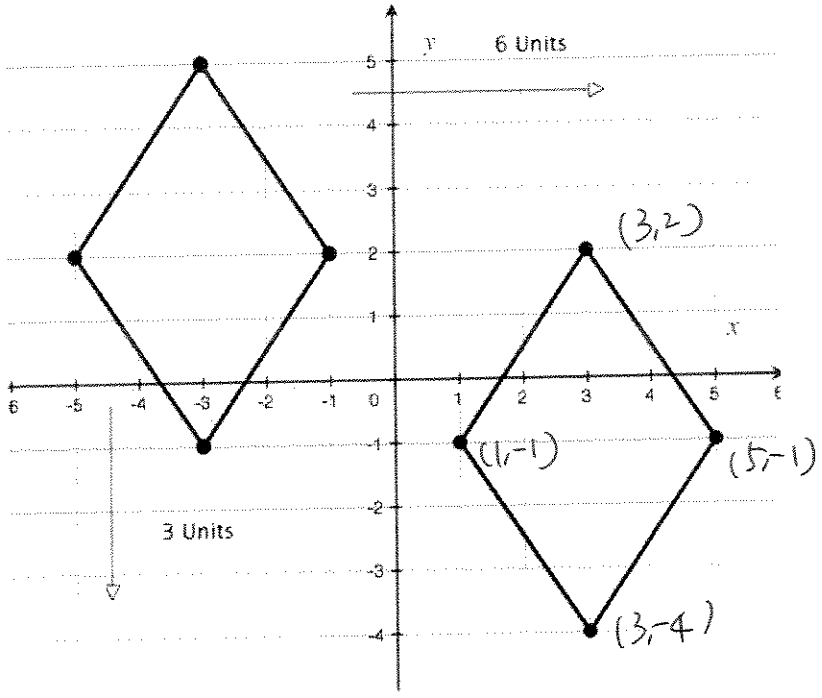



**3.1.46: *Fuel Efficiency*** The table shows various speeds $x$ of a car in miles per hour and the corresponding approximate fuel efficiencies $y$ in miles per gallon.

| $x$ | 50 | 55 | 60 | 65 | 70 |
|---|---|---|---|---|---|
| $y$ | 35 | 33.8 | 32.2 | 30 | 27.5 |



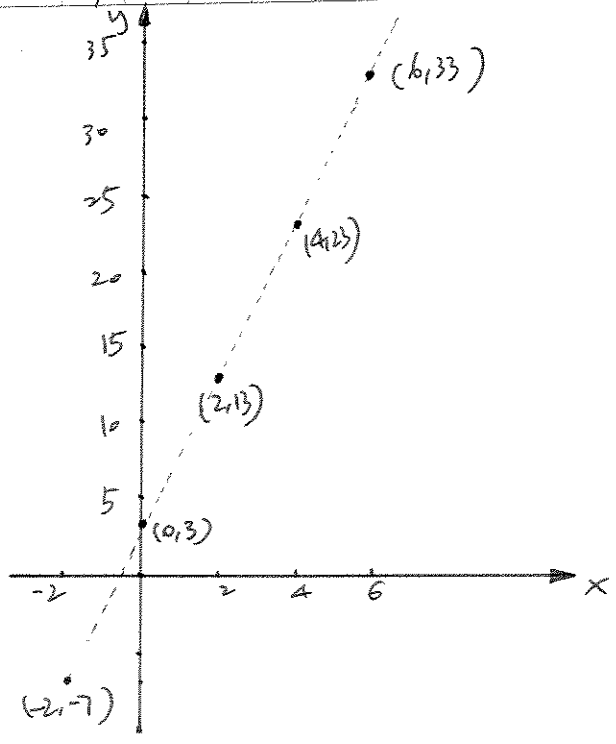
**3.1.48:** The figure is shifted to a new location in the plane. Find the coordinates of the vertices of the figure in its new location.




Complete the table of values. Then plot the solution points on a rectangular coordinate system.

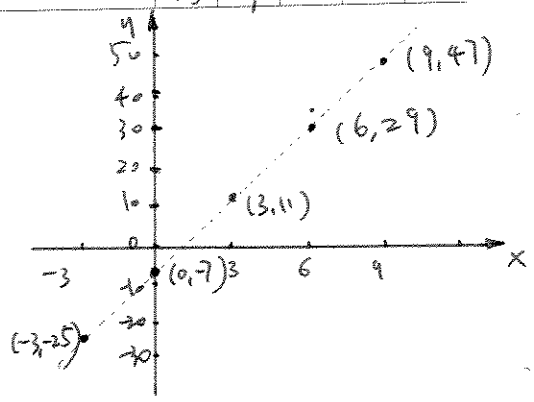
**3.1.49:**

| $x$ | -2 | 0 | 2 | 4 | 6 |
|---|---|---|---|---|---|
| $y = 5x + 3$ | -7 | 3 | 13 | 23 | 33 |



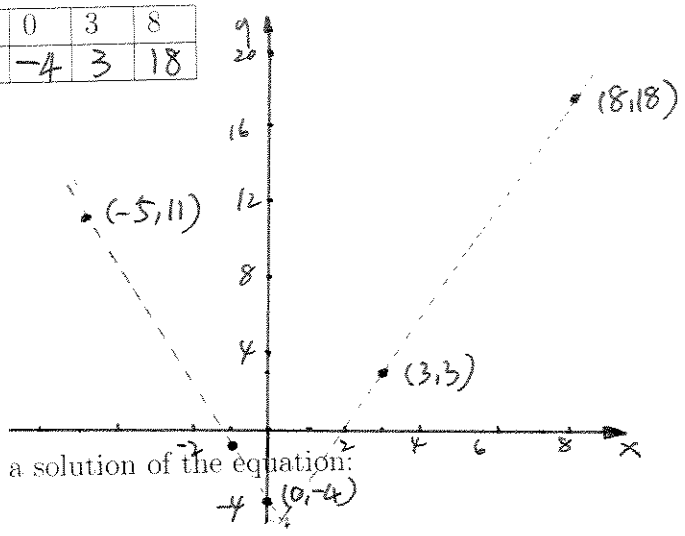
**3.1.50:**

| $x$ | -3 | 0 | 3 | 6 | 9 |
|---|---|---|---|---|---|
| $y = 6x - 7$ | -25 | -7 | 11 | 29 | 47 |




**3.1.52:**

| $x$ | -5 | -1 | 0 | 3 | 8 |
|---|---|---|---|---|---|
| $y = \lvert -3x + 1 \rvert - 5$ | 11 | -1 | -4 | 3 | 18 |




Determine whether each ordered pair is a solution of the equation:

**3.1.55:** $4y - 2x + 1 = 0$

(a) $(0, 0)$ Not a Solution

(b) $(\frac{1}{2}, 0)$ Solution

(c) $(-3, -\frac{7}{4})$ Solution

(d) $(1, -\frac{3}{4})$ Not a Solution

**3.1.60:** $y^2 - 4x = 8$

(a) $(0, 6)$ Not a Solution

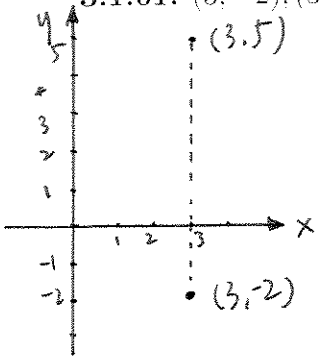
(b) $(-4, 2)$ Not a Solution

(c) $(-1, 3)$ Not a Solution

(d) $(7, 6)$ Solution

Plot the points and find the distance between them. State whether the points lie on a horizon or a vertical line.

**3.1.61:** $(3,-2),(3,5)$

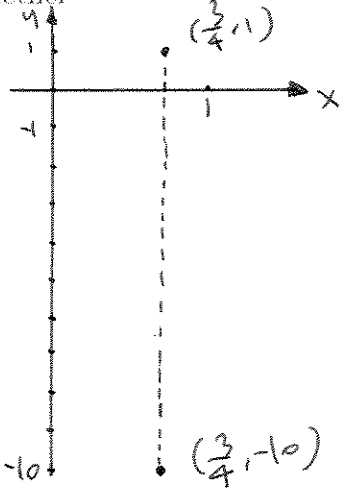



$d=7$, vertical line;

**3.1.66:** $(\frac{3}{4},1),(\frac{3}{4},-10)$

$d=11$

vertical line;




Find the distance between the points.

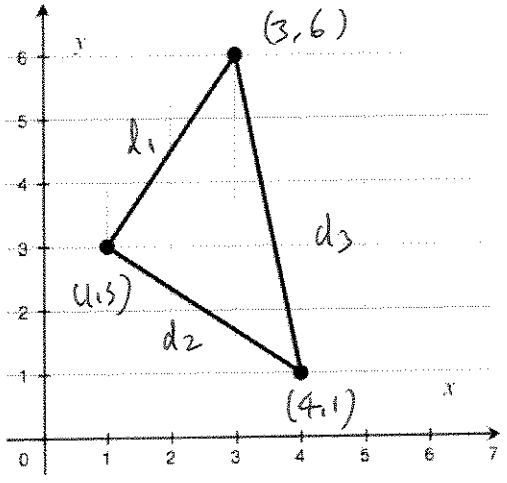
**3.1.69:** $(1,3),(5,6)$

$\sqrt{(1-5)^2+(3-6)^2}=5$

**3.1.74:** $(0,-5),(2,-8)$

$\sqrt{(0-2)^2+(-5-(-8))^2}=\sqrt{13}$

**3.1.79:** Show that the points are vertices of a right triangle.




$d_1=\sqrt{13}$, $d_2=\sqrt{13}$, $d_3=\sqrt{26}$;

$(\sqrt{13})^2+(\sqrt{13})^2=(\sqrt{26})^2$, by the converse of the Pythagorean Theorem, it is a right angle.

Use the Distance Formula to determine whether the three points are collinear.

**3.1.83:** $(2,3),(2,6),(6,3)$

Not collinear;

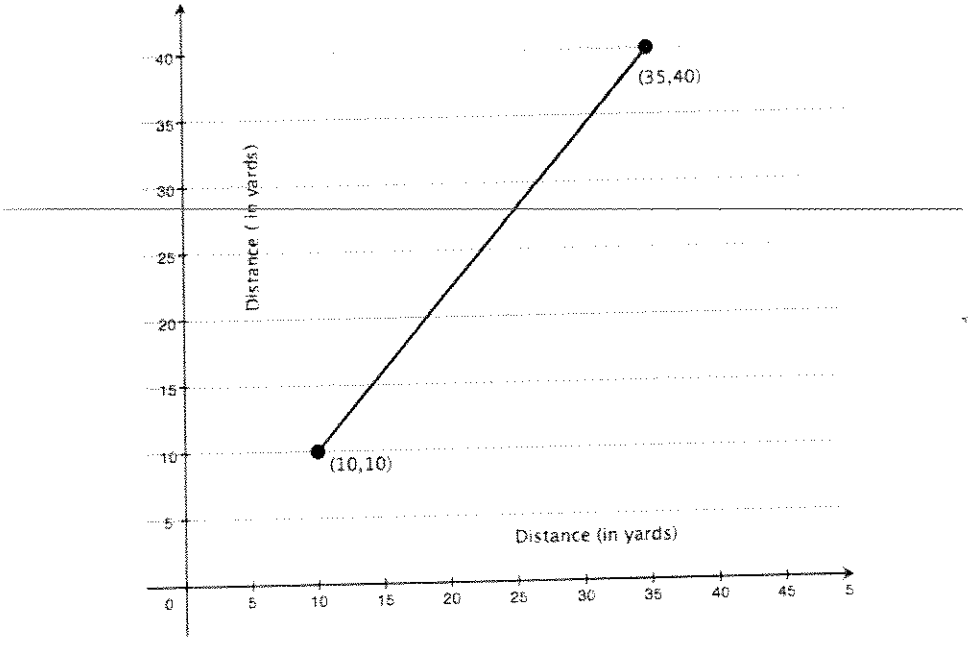
**3.1.86:** $(2,4),(1,1),(0,-2)$

Collinear;

**3.1.93:** ***Numerical Interpretation*** For a handyman to install $x$ windows in your home, the cost $y$ is given by $y = 150x + 425$. Use $x$-values of $1, 2, 3, 4$, and $5$ to help describe the relationship between the number of windows $x$ and the cost of installation $y$.

| $x$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $y$ | 575 | 725 | 875 | 1025 | 1175 |

**3.1.95:** ***Football Pass*** A football quarterback throws a pass from the 10-yard line, 10 yards from the sideline. The pass is caught by a wide receiver on the 40-yard line, 35 yards from the same sideline, as shown in the figure. How long is the pass?

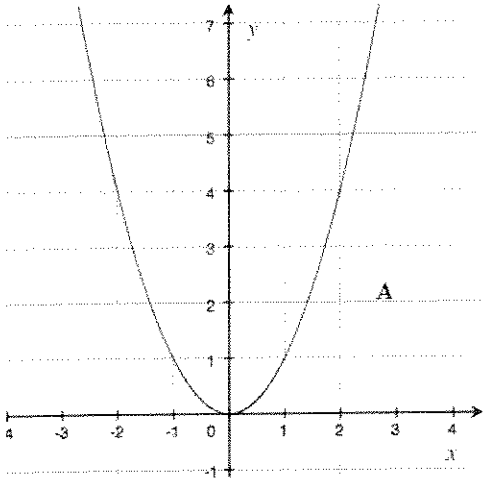


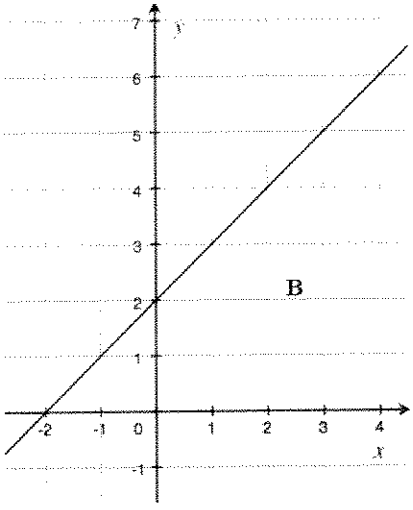

$\sqrt{(35-10)^2+(40-10)^2} = \sqrt{1525} \approx 39.05$

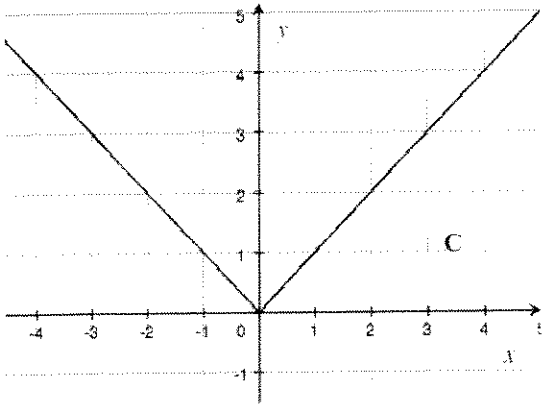
The pass is about 39.05 yards long.

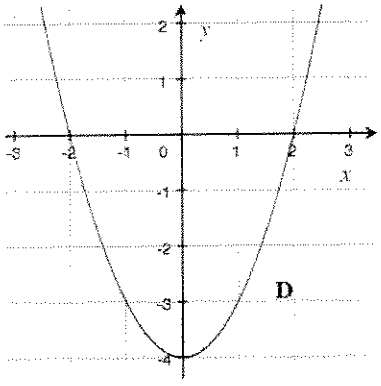
## 3.2 Graphs of Equations

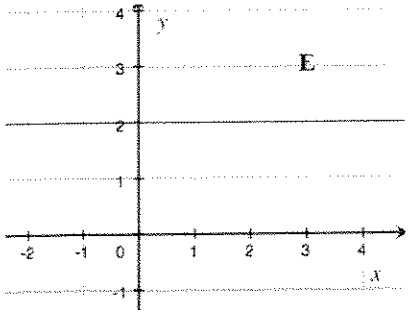
Match the equation with the label of its graph.

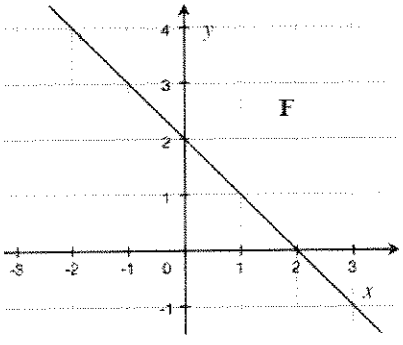


**3.2.1:** $y = 2$ E

**3.2.2:** $y = 2 + x$ B

**3.2.3:** $y = 2 - x$ F

**3.2.4:** $y = x^2$ A

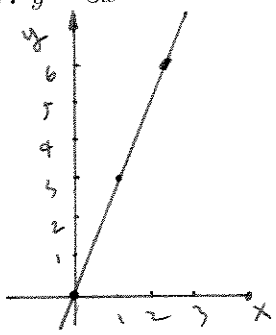
**3.2.5:** $y = x^2 - 4$ D

**3.2.6:** $y = |x|$ C

Sketch the graph of the equations.

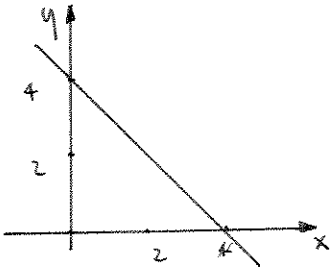
**3.2.7:** $y = 3x$

| x | y |
|---|---|
| 0 | 0 |
| 1 | 3 |



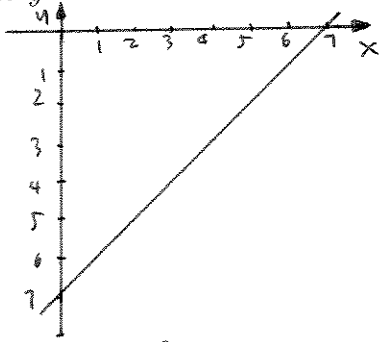
**3.2.9:** $y = 4 - x$

| x | y |
|---|---|
| 4 | 0 |
| 0 | 4 |



**3.2.10:** $y = x - 7$

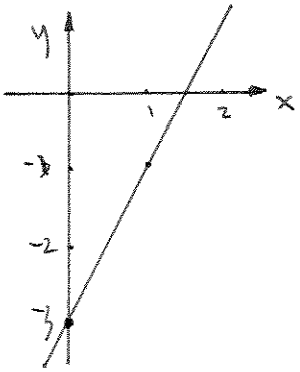
| x | y |
|---|---|
| 0 | -7 |
| 7 | 0 |



**3.2.11:** $2x - y = 3$

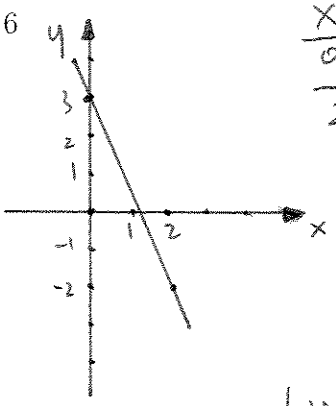
$y = 2x - 3$

| x | y |
|---|---|
| 0 | -3 |
| 1 | -1 |



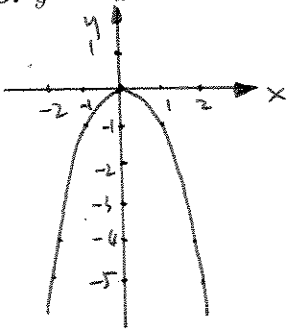
**3.2.14:** $2y + 5x = 6$

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



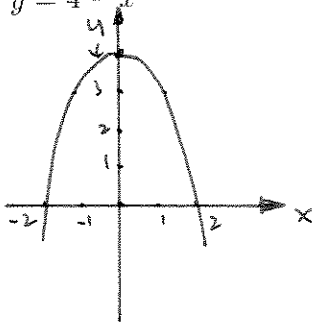
| x | y |
|---|---|
| 0 | 3 |
| 2 | -2 |

**3.2.15:** $y = -x^2$



| x | y |
|---|---|
| 0 | 0 |
| 1 | -1 |
| -1 | -1 |
| 2 | -4 |
| -2 | -4 |

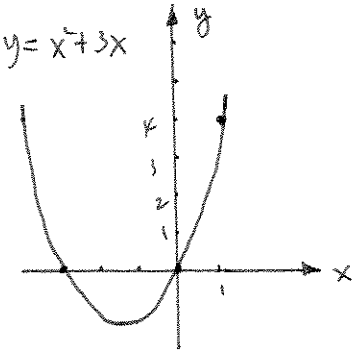
**3.2.18:** $y = 4 - x^2$



| x | y |
|---|---|
| 0 | 4 |
| 1 | 3 |
| -1 | 3 |
| 2 | 0 |
| -2 | 0 |

**3.2.19:** $-x^2 - 3x + y = 0$

$y = x^2 + 3x$

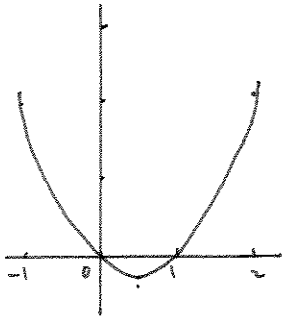


| x | y |
|---|---|
| 0 | 0 |
| -3 | 0 |
| 1 | 4 |
| -4 | 4 |

**3.2.20:** $-x^2 + x + y = 0$

$y = x^2 - x$

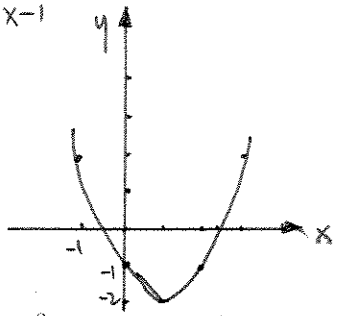
| x | y |
|---|---|
| 0 | 0 |
| 1 | 0 |
| 2 | 2 |
| -1 | 2 |



**3.2.21:** $x^2 - 2x - y = 1$

$y = x^2 - 2x - 1$

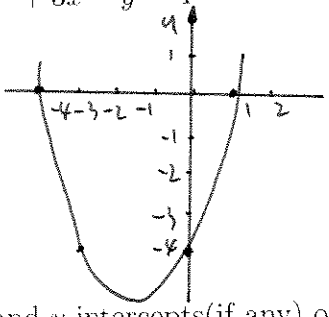
| x | y |
|---|---|
| 0 | -1 |
| 2 | -1 |
| -1 | 2 |
| 3 | 2 |



**3.2.22:** $x^2 + 3x - y = 4$

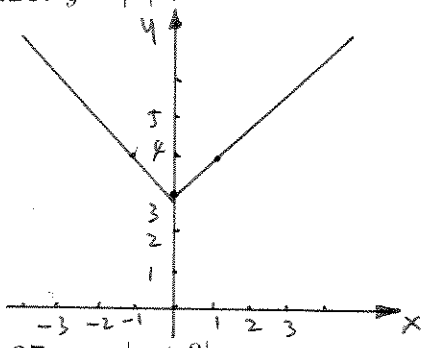
$y = x^2 + 3x - 4$

| x | y |
|---|---|
| 1 | 0 |
| -4 | 0 |
| 0 | -4 |
| -3 | -4 |



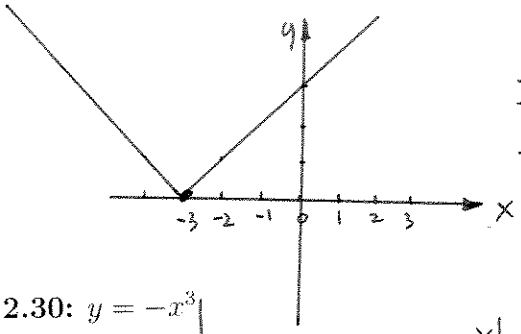
**3.2.25:** $y = |x| + 3$

| x | y |
|---|---|
| 0 | 3 |
| 1 | 4 |
| -1 | 4 |



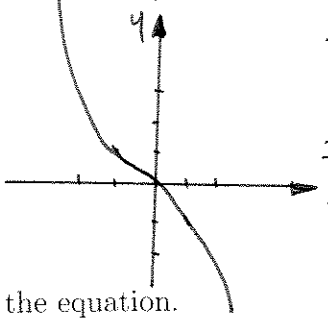
**3.2.27:** $y = |x + 3|$

| x | y |
|---|---|
| 0 | 3 |
| 1 | 4 |
| -3 | 0 |
| -4 | 1 |



**3.2.30:** $y = -x^3$

| x | y |
|---|---|
| 0 | 0 |
| 1 | -1 |
| -1 | 1 |



Find the $x$-and $y$-intercepts(if any) of the graph of the equation.

**3.2.31:** $y = 6x - 3$

x-intercept $(\frac{1}{2}, 0)$

y-intercept $(0, -3)$

**3.2.34:** $y = \frac{3}{4}x + 15$

x-intercept $(-20, 0)$

y-intercept $(0, 15)$

**3.2.37:** $4x - y + 3 = 0$

x-intercept $(-\frac{3}{4}, 0)$

y-intercept $(0, 3)$

**3.2.40:** $y = |x| + 4$

x-intercept: none

y-intercept: $(0, 4)$

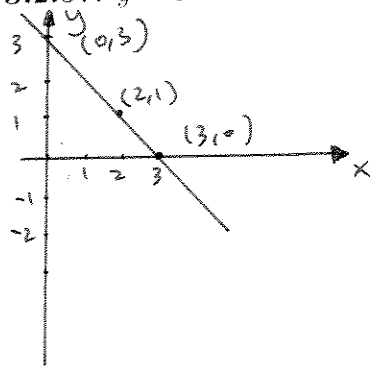
**3.2.42:** $y = |x - 4|$

x-intercept $(4, 0)$

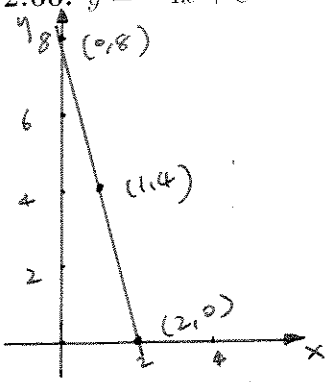
y-intercept $(0, 4)$

Sketch the graph of the equation and show the coordinates of three solution points (including $x$- and $y$- intercepts).

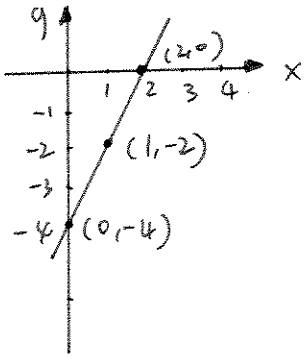
**3.2.57:** $y = 3 - x$



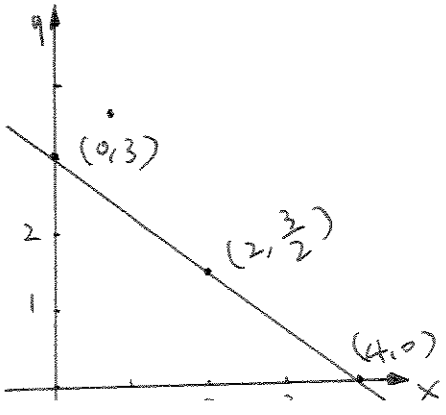

**3.2.60:** $y = -4x + 8$



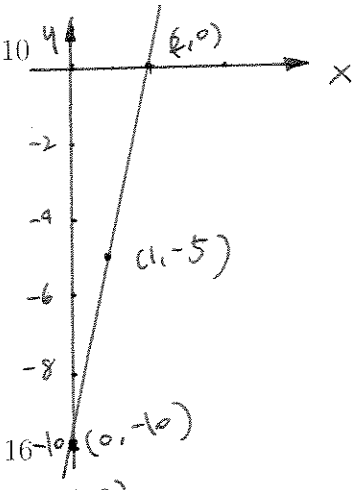

**3.2.62:** $y - 2x = -4$



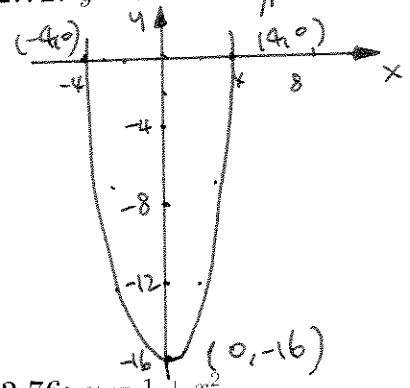

**3.2.65:** $3x + 4y = 12$



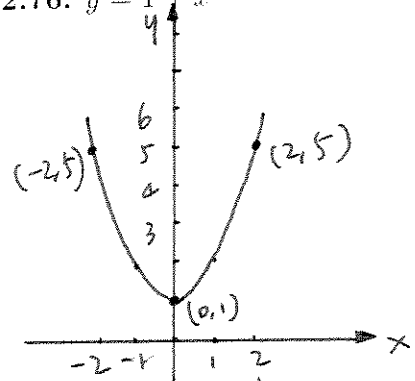

**3.2.69:** $5x - y = 10$



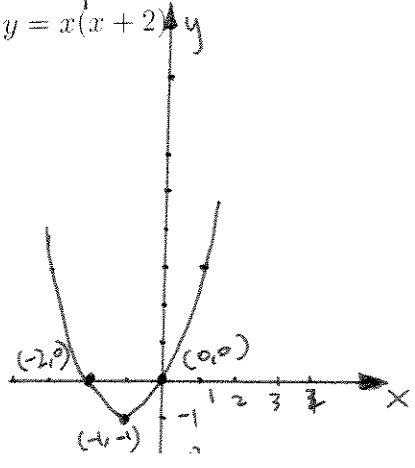

**3.2.72:** $y = x^2 - 16$



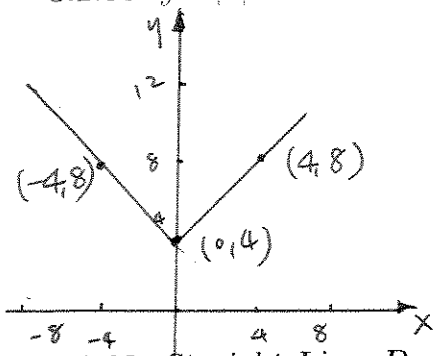

**3.2.76:** $y = 1 + x^2$



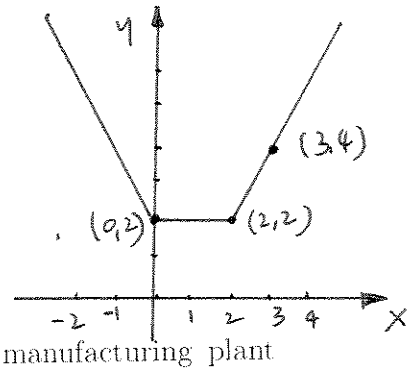

**3.2.80:** $y = x(x + 2)$



**3.2.86:** $y = |x| + 4$



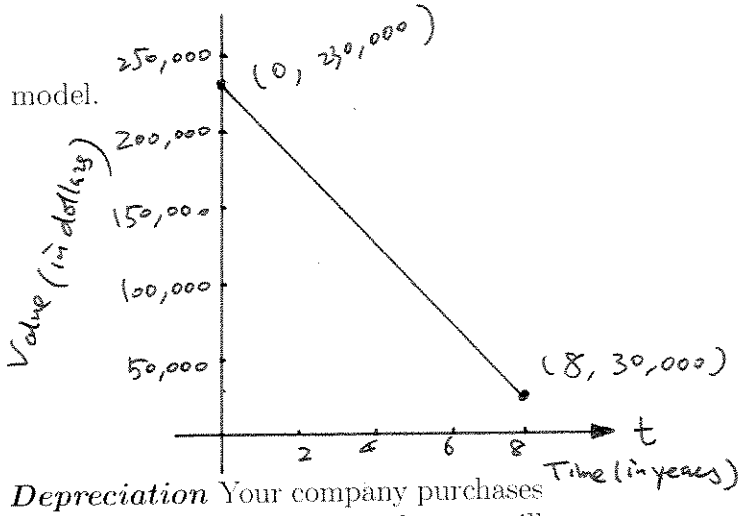

**3.2.92:** $y = |x| + |x - 2|$




**3.2.93:** ***Straight-Line Depreciation*** A manufacturing plant purchases a new molding machine for \$230,000. The depreciated value $y$ after $t$ years is given by

$$y = 230,000 - 25,000t, 0 \leq t \leq 8.$$

Sketch a graph of this model.



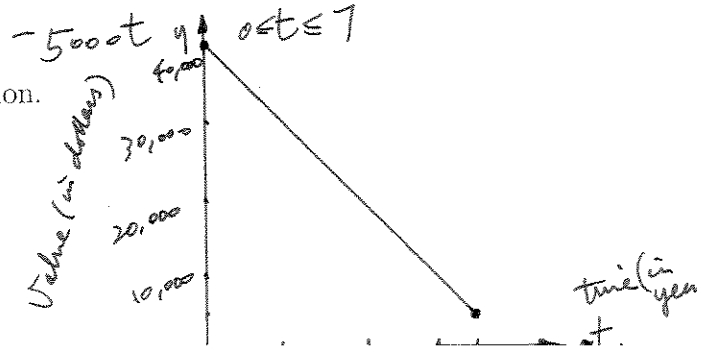

**3.2.95:** ***Straight-Line Depreciation*** Your company purchases a new delivery van for \$40,000. For tax purposes, the van will be depreciated over a seven-year period. At the end of the 7 years, the value of the van is expected to be \$5000.

(a) Find an equation that relates the depreciated value of the van to the number of years since it was purchursed.

annual depreciation $\frac{40,000 - 5000}{7} = 5000$

So $y = 40,000 - 5000t$ $0 \leq t \leq 7$

(b) Sketch the graph of the equation.



(c) What is the $y$- intercept of the graph and what does it represent?

y-intercept : (0, 40,000)

it represents the value of the delivery van when it was purchursed

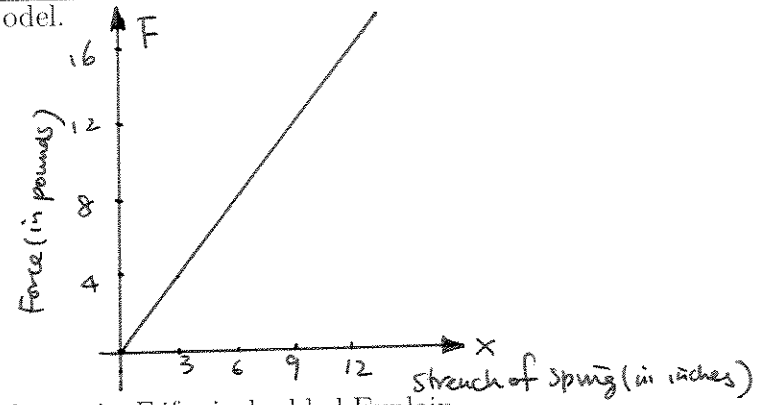
**3.2.97: *Hooke's Law*** The force $F$(in pounds) required to stretch a spring $x$ inches from its natural length is given by

$$F = \frac{4}{3}x, \quad 0 \leq x \leq 12.$$

(a) Use the model to complete the table.

| $x$ | 0 | 3 | 6 | 9 | 12 |
|---|---|---|---|---|---|
| $F$ | 0 | 4 | 8 | 12 | 16 |

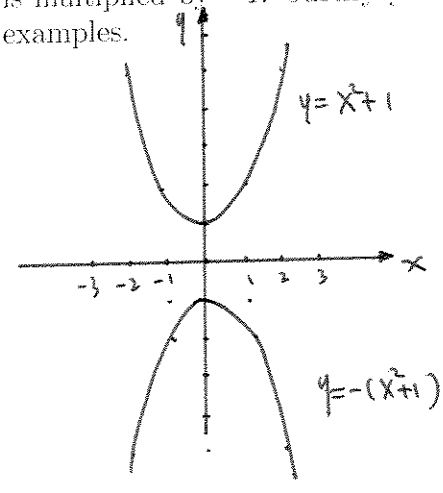
(b) Sketch a graph of the model.




(c) Determine the required change in $F$ if $x$ is doubled.Explain your reasoning.

F doubles because F is directly proportional to X.

**3.2.100: *Exploration*** Graph the equations $y = x^2 + 1$ and $y = -(x^2 + 1)$ on the same set of coordinate axes. Explain how the graph of an equation changes when the expression for $y$ is multiplied by $-1$. Justify your answer by giving additional examples.




when the expression for y is multiplied by -1, the graph is reflected in the x-axis.

(additional Example : $y=x^2$ and $y=-x^2$