1. a) Find the slope of the line passing through points $(3, -1)$ and $(-5, 2)$.

\[
\text{Slope } m = \frac{\Delta y}{\Delta x} = \frac{2 - (-1)}{-5 - 3} = \frac{-3}{8}
\]

\[
\text{Answer: } x \text{ increases by } \frac{16}{3} + \frac{16}{3}
\]

b) If $y$ changes by $-2$ units, what is the corresponding change in $x$?

\[
m = -\frac{3}{8} \quad \text{point } (3, -1)
\]

\[
y - y_0 = m(x - x_0)
\]

\[
y - (-1) = -\frac{3}{8}(x - 3)
\]

\[
y + 1 = -\frac{3}{8}x + \frac{9}{8}
\]

\[
y = -\frac{3}{8}x + \frac{1}{8}
\]

2. Find an equation of the vertical line passing through $(2, -3)$.

\[
| x = 2 |
\]
3. Find the intersection point of the lines $y = 2x + 5$ and $3x - y = 2$.

\[
\begin{align*}
\begin{cases}
  y &= 2x + 5 \\
  3x - y &= 2
\end{cases} 
\implies & 3x - (2x + 5) = 2 \\
& 3x - 2x - 5 = 2 \\
& x = 7 \\
& y = 2x + 5 = 2(7) + 5 = 14 + 5 = 19 \\
(7, 19)
\end{align*}
\]

4. A manufacturer finds that the number of units $x$ she produces and the cost $y$ of producing $x$ units are related by a linear function $y = mx + b$.

a) If it costs $2300 to produce 10 units and $2450 to produce 15 units, what does it cost to produce 20 units?

\[
\begin{align*}
\text{Answer } &= \$2600 \\
\text{Find the cost equ.} \\
\begin{cases}
  (10, 2300) \\
  (15, 2450)
\end{cases} \\
& m = \frac{2450 - 2300}{15 - 10} = \frac{150}{5} = 30 \\
& y = 30x - 300 + 2300 \\
& y - 2300 = 30(x - 10) \\
& y = 30x + 2000
\end{align*}
\]

b) What are the fixed costs?

\[
\text{Answer: } \$2000
\]
5. At the corner’s pasta restaurant it is expected that 350 dishes will be sold at a price of $10 each. For each $0.20 reduction in price, 15 more dishes will be sold. The restaurant is willing to supply 325 pasta dishes at $5 each, and 475 dishes at $11 each.

a) Find the linear demand equation of the pasta dish.

\[
m = \frac{9.80 - 10}{365 - 350} = - \frac{0.20}{15} = - \frac{1}{75}
\]

\[
y - 10 = - \frac{1}{75} (x - 350) \Rightarrow y = - \frac{1}{75} x + \frac{350 + 10}{75}
\]

b) Find the linear supply equation of the pasta dish.

\[
m = \frac{4.75 - 5}{475 - 325} = \frac{1}{25}
\]

\[
y - 5 = \frac{1}{25} (x - 325) \Rightarrow y = \frac{1}{25} x - \frac{325}{25} + 5
\]

\[
y = \frac{1}{25} x - 8
\]

c) Find the equilibrium price and quantity of the pasta dish.

Supply = demand.

\[-\frac{1}{75} x + \frac{44}{3} = \frac{1}{25} x - 8\]

\[
\frac{44}{3} + 8 = (\frac{1}{25} + \frac{1}{75}) x = 17\frac{34}{25}
\]

\[
\frac{68}{3} = \frac{4}{75} x \Rightarrow x = \frac{68}{4} = 17\frac{2}{3}
\]

Answer: 425 dishes at \(\frac{1}{25} \times 425 - 8 = \$9\) each.
6. Determine the break-even point for a firm that has a fixed monthly cost of $36,000 and a cost of $37,200 when 100 units are produced, if the products are sold at $30 per unit.

Need to find out the cost of producing one item.

\[ C = \text{Fixed costs} + (\text{cost/unit}) \times (\text{# of units produced}) \]

\[ 37,200 = 36,000 + (\text{cost/unit}) \times 100 \]

\[ 37200 - 36000 = 100 \times (\text{cost/unit}) \]

\[ 1200 = 100 \times (\text{cost/unit}) \]

\[ \frac{1200}{100} = (\text{cost/unit}) \]

Break-even pt: \( C = R \)

\[ C = 36000 + 12 \times \quad R = 30 \times \]

\[ 36000 + 12 \times = 30 \times \]

\[ 36000 = 18 \times \]

\[ \frac{36000}{18} = \times \quad \Rightarrow \quad x = \frac{2000}{\text{units}} \]

\[ R = C = 30 \times 2000 = $60,000 \]
7. A line contains the point (2, 5). As $x$ decreases by 3 units, $y$ decreases by 1 unit. Find an equation for the line.

\[ m = \frac{4-5}{-1-2} = \frac{-1}{-3} = \frac{1}{3} \]

\[ y - 4 = \frac{1}{3} (x - (-1)) \]
\[ y - 4 = \frac{1}{3} x + \frac{1}{3} \]
\[ y = \frac{1}{3} x + \frac{1}{3} + 4 = \frac{1}{3} x + \frac{13}{3} = y \]

8. A piece of office equipment is bought for $59,555. Its value after 5 years is $5,600. Find the depreciation and the straight line equation of the equipment’s value as a function of time.

\[ \text{Depreciation rate} = \frac{5600 - 59555}{5} \quad \text{\$} \quad = \frac{-53955}{5} \]
\[ = -10791 \text{ \$ per year} \]

After 3 years, the value of the equipment will be

\[ 59555 - 10791 \times 3 \]

\[ V = 59555 - 10791t \]

where $t$ = # of years since equipment is first bought.
9. The quantity demanded of a certain brand of DVD player is 3000 per week when the unit price is $485. For each decrease in unit price of $20 below $485, the quantity demanded increases by 250 units. The suppliers will not market any DVD players if the unit price is $300 or lower. But at a unit price of $525, they are willing to make available 2500 units in the market. The supply equation is also known to be linear.

a) Find the demand equation.

\[ (3000, 485) \quad (3250, 465) \]

\[ m = \frac{25}{-25} = -\frac{2}{25} \]

\[ y - 485 = -\frac{2}{25} (x - 3000) \]

\[ y = -\frac{2}{25} x + \frac{6000}{25} + 485 \]

\[ y = -\frac{2}{25} x + 725 \quad \text{Demand eqn.} \]

b) Find the supply equation.

\[ (0, 300) \quad (2500, 525) \]

\[ m = \frac{525 - 300}{2500 - 0} = \frac{225}{2500} = 0.09 \]

\[ y - 300 = 0.09 (x - 0) \]

\[ y = 0.09 x + 300 \quad \text{Supply eqn.} \]

c) Find the equilibrium quantity and price.

\[ \text{Demand} = \text{Supply} \quad \rightarrow \quad -\frac{2}{25} x + 725 = 0.09 x + 300 \]

\[ 225 - 300 = (0.09 + \frac{2}{25}) x \]

\[ 425 = 0.17 x \quad \rightarrow \quad x = \frac{425}{0.17} = 2500 \quad \text{eq. quantity} \]
10. A new building that costs $1,300,000 has a useful life of 100 years and a scrap value of $500,000. Using straight-line depreciation, find the equation for the value $V$ in terms of $t$, where $t$ is in years. Find the value after 1 year, after 2 years, and after 90 years.

\[ m = \frac{500000 - 1300000}{100 - 0} = \frac{-800000}{100} = -8000 \text{ \$/yr} \]

\[ y - 1300000 = -8000(x - 0) \]

\[ V = -8000t + 1300000 \]

\[ V(1 \text{ yr}) = 1300000 - 8000 = 1292000 \]

\[ V(2) = 1300000 - 16000 = 1284000 \]

\[ V(90) = 1300000 - 8000 \times 9 = 580000 \]

**Extra Problems.**

The length and weight of a particular species of animals have a linear relationship. An animal of this species that is 7 in long weighs 2 lb.
For every 7 in increase in length, the animal's weight increases by 2 lb.

a) Find linear eqn. relating $w$ with $l.\\n(7 \text{ in, } 2 \text{ lb}) \quad (14 \text{ in, } 4 \text{ lb})\\n\text{or (0 in, 0 lb)}

Slope = \frac{2}{7}

y - 0 = \frac{2}{7} (x - 0) \quad y = \frac{2}{7} x

\begin{align*}
\text{or} \quad w &= \frac{2}{7} l
\end{align*}

(b) What is the length of an animal of this species that weighs 11 lb?

$w = 11$ solve for $l$

\begin{align*}
11 &= \frac{2}{7} l \quad \Rightarrow \quad l = \frac{7}{2} \cdot 11 = \frac{77}{2} = \\
&= 38.5 \text{ in}
\end{align*}