**Aim #41:** How can we use piecewise functions to solve word problems?

**Homework:** Handout

**Do Now:** Evaluate the following using the given piecewise function.

\[ f(x) = \begin{cases} 
8, & x < -4 \\
-2x, & -4 \leq x \leq 2 \\
5x - 10, & x > 2
\end{cases} \]

- \( f(1) = \square \)
- \( f(-5) = \square \)
- \( f(3) = \square \)
- \( f(-4) = \square \)

If you earned up to $113,700 in 2013 from an employer, your Social Security tax rate was 6.2% of your income. If you earned over $113,700, you pay a fixed amount of $7,049.40.

a. Write a piecewise linear function to represent the Social Security taxes for incomes between $0 and $500,000.

\[ f(x) = \begin{cases} 
0.062x, & 0 < x \leq 113700 \\
7049.40, & 113700 < x < 500000
\end{cases} \]

b. How much Social Security tax would someone who made $50,000 owe?

\[ f(50000) = 0.062(50000) = \$3100 \]

c. How much money would you have made if you paid $4000 in social security tax in 2013.

\[ 4000 = 0.062x \]

\[ x = \$64,516.13 \]

d. What is the meaning of \( f(150,000) \)? What is the value?

\[ f(150,000) = \$7049.40 \]

If your salary is $150,000, then you pay $7049.40 in Social Security tax.
During a snowstorm, a meteorologist tracks the amount of accumulating snow. For the first three hours of the storm, the snow fell at a constant rate of one inch per hour. The storm then stopped for two hours and then started again at a constant rate of one-half inch per hour for the next four hours.

a. Create a graph of the situation.

b. When will the depth of the snow be 4 inches?

at 7 hrs

\[ 3 \text{ in, } \frac{1}{2}x + \frac{1}{2} \]

c. How much snow will there be on the ground after 4 hours?

\[ \frac{1}{2}x + \frac{1}{2} \]

d. Write a piecewise defined function that models the depth of the snow as a function of time.

\[
f(x) = \begin{cases} 
  x & 0 \leq x \leq 3 \\
  \frac{1}{2}(x-5) + 3 & 3 < x \leq 9 \\
  \frac{1}{2}x - \frac{5}{2} + 3 & 5 < x \leq 9 \\
  \frac{1}{2}x + \frac{1}{2} & \text{otherwise}
\end{cases}
\]
Your favorite dog groomer charges according to your dog's weight. If your dog is 15 pounds and under, the groomer charges $35. If your dog is between 15 and 40 pounds, including 40 lbs, she charges $40. If your dog is over 40 pounds, she charges $40, plus an additional $2 for each pound over 40 lbs.

a. Write a piecewise function that describes what your dog groomer charges.

\[ f(x) = \begin{cases} 
35, & 0 < x \leq 15 \\
40, & 15 < x \leq 40 \\
2(x-40) + 40, & x > 40 
\end{cases} \]

b. Graph the function.

c. What would the groomer charge if your bulldog weighs 60 pounds?

\[ f(60) = 2(60-40) + 40 = 80 \]

d. What would your dog weigh if she charged $190?

\[ 190 = 2(x-40) + 40 \\
150 = 2(x-40) \\
75 = x - 40 \\
115 = x \]
You plan to sell Bazinga! t-shirts as a fundraiser. The wholesale t-shirt company charges you $10 a shirt for the first 75 shirts. After the first 75 shirts you purchase up to 150 shirts, the company will lower its price to $7.50 per shirt. After you purchase 150 shirts, the price will decrease to $5 per shirt. Write a piece-wise function that models this situation.

\[ f(x) = \begin{cases} 
10x & 0 \leq x \leq 75 \\
7.50(x - 75) + 750 & 75 < x \leq 150 \\
5(x - 150) + 1312.5 & x > 150 
\end{cases} \]

How much would 220 shirts cost?

\[ f(220) = 5(220 - 150) + 1312.5 = 1662.50 \]

If the total cost was $2062.50, how many shirts were purchased?

\[ 2062.50 = 5(x - 150) + 1312.50 \]

\[ x = 300 \text{ shirts} \]

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**Sum It Up!!**

When writing piecewise functions from a word problem, not only must we create equations but also identify domain restrictions!