Essential Question: How do we write and graph piecewise and step functions from real-life situations?

Do Now:

When a diabetic takes long-acting insulin, the insulin reaches its peak effect on the blood sugar level in about three hours. This effect remains fairly constant for 5 hours, then declines, and is very low until the next injection. In a typical patient, the level of insulin might be modeled by the following function.

$$f(t) = \begin{cases} 40t + 100 & \text{if } 0 \le t \le 3 \\ 220 & \text{if } 3 < t \le 8 \\ -80t + 860 & \text{if } 8 < t \le 10 \\ 60 & \text{if } 10 < t \le 24 \end{cases}$$

Here, $f(t)$ represents the blood sugar level at time t hours after the time of the injection. If a patient takes insulin at 6 am, find the blood sugar level at each of the following times.
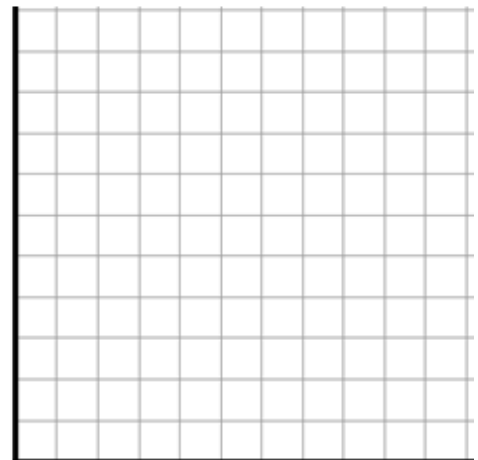
a. 7 am   b. 11 am   c. 3 pm   d. 5 pm

❖ **Consider creating a table to organize the information.**

(1) You rent a karaoke machine for 5 days. The rental company charges $50 for the first day and $25 for each additional day. Write and graph a step function that represents the relationship between the number of days x and the total cost of renting the karaoke machine.

(2) For a cellular phone billing plan, $50 per month buys 400 minutes or less. Additional time costs $0.30 per minute. Let the monthly cost $C(x)$ be a function of the time x.

a) Write a piecewise function to represent this situation.

b) Graph the function.
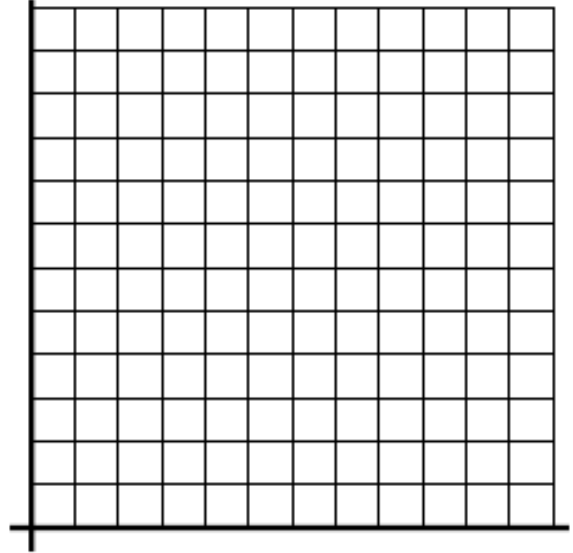
(3) Your favorite dog groomer charges according to your dog's weight. If your dog is 15 pounds and under, the groomer charges $35. If your dog is between 15 and up to 50 pounds, she charges $40. If your dog is over 50 pounds, she charges $40, plus an additional $2 for each pound.

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

b. Graph the function.
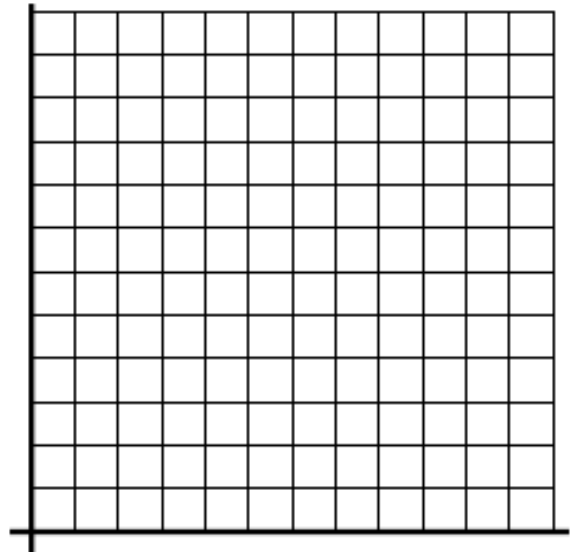
c. What would the groomer charge if your dog weighs 60 pounds?