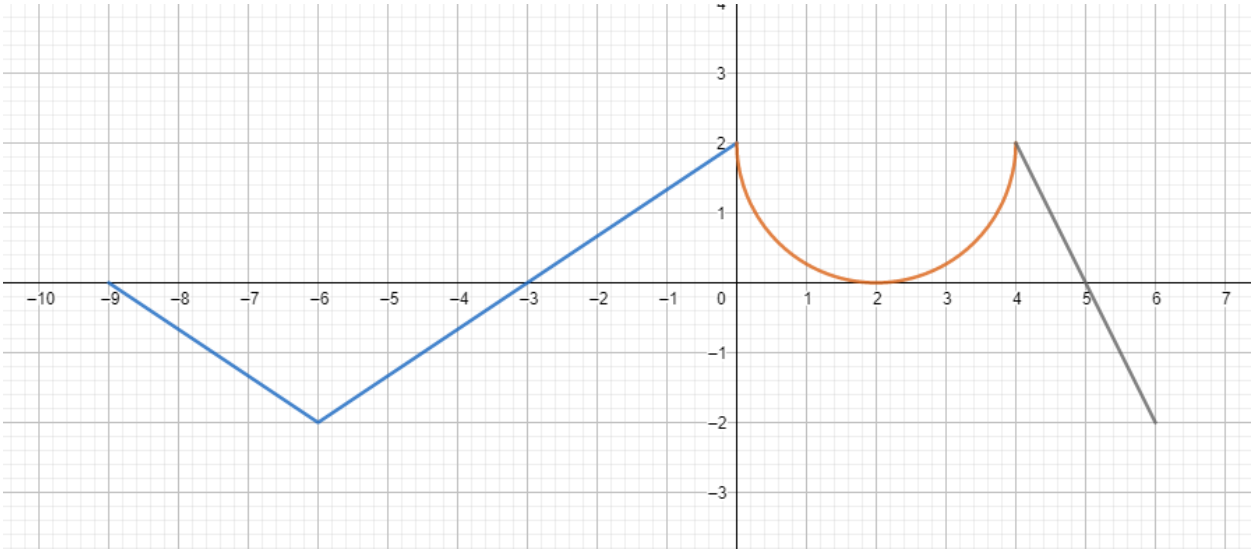
How many different ways can Dixie use this one graph?



The graph above consists of 3 line segments and a semi-circle. It is the first graph Dixie created by herself using Geogebra (though Bryan Passwater helped with email advice.)

Round 1: The graph above shows f', the derivative of the function f.

a) For what values of x in the interval $-9 < x < 6$ does $f(x)$ have a relative maximum? Justify your answer.

b) Over what intervals of x is $f(x)$ increasing and concave down?

c) Find the x-coordinate of each point of inflection on the graph of $f(x)$. Justify your answer.

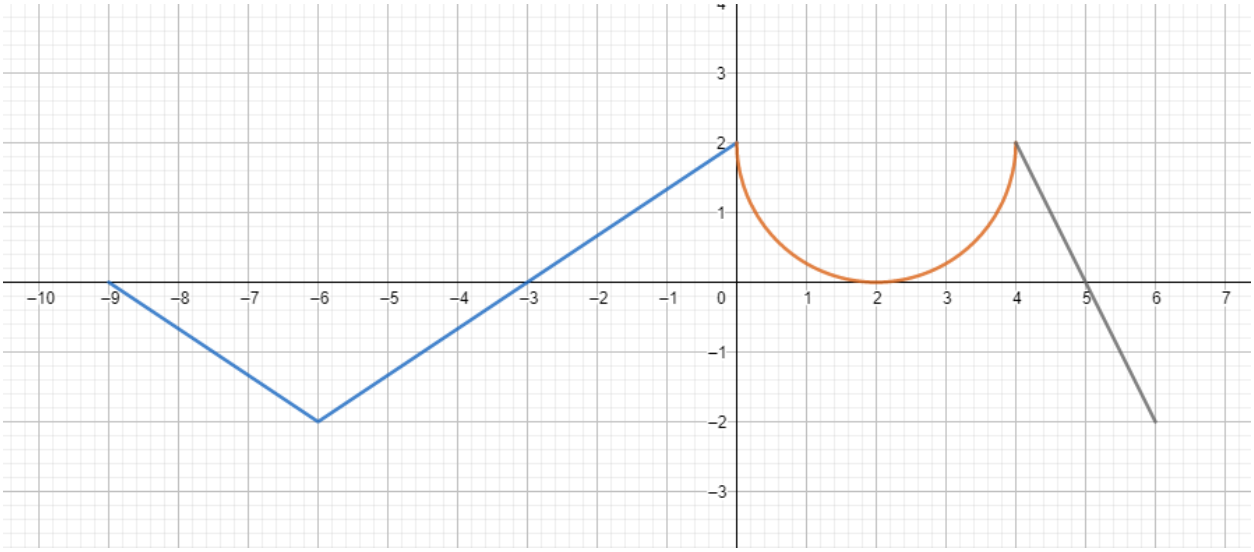
d) Determine the value of $\lim_{h\to 0} \frac{f(-3+h)-f(-3)}{h}$, or state that it does not exist.

e) Determine the value of $\lim_{h\to 0} \frac{f'(-3+h)-f'(-3)}{h}$, or state that it does not exist.

f) Determine values of $f''(-2)$, $f''(0)$, $f''(2)$, or state that they do not exist.

g) Over what interval is there guaranteed to be a value c such that $f''(c) = 1$? Justify your answer.

h) If $f(-3) = 5$, find the value of $f(-9)$. *This one doesn't belong in this unit since it involves integration but I liked the question so I kept it here.



The graph above consists of 3 line segments and a semi-circle.

Round 2: The graph above shows the velocity $v(t)$ of a particle moving on the x-axis with position $x(t)$ measured in inches and time, t, measured in minutes.

a) Using correct units, find the value of and explain the meaning of $v'(-4)$ in the context of the problem.

b) Using correct units, explain the meaning of $\frac{1}{9}\int_{-3}^{6}|v(t)|\,dt$.

c) Find the displacement of the particle from $t = -9$ to $t = 0$.

d) Find the total distance travelled by the particle from $t = -9$ to $t = 0$.

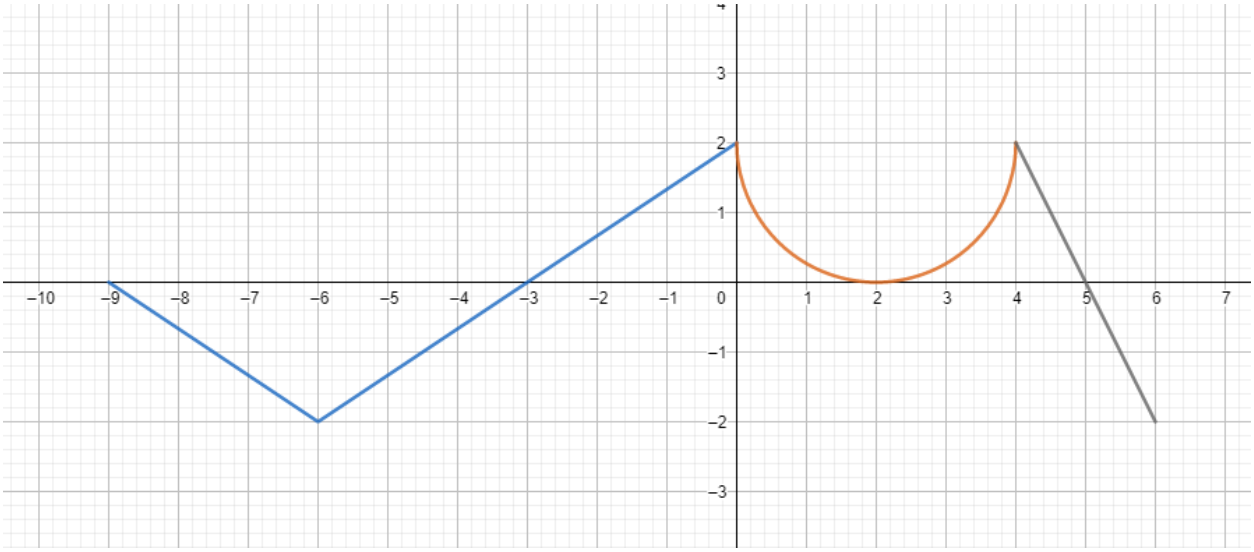
e) If $x(0) = 4$, find the position of the particle at $t = 2$.

f) If $x(0) = 4$, when is the particle farthest to the right? Justify your answer.

g) Name two intervals of time when the displacement of the particle would equal zero.

h) At $t = -4$, is the speed of the particle increasing or decreasing. How do you know?

i) If $x(0) = 4$, then at $t = -6$, is the particle moving toward or away from the origin? How do you know?



The graph above consists of 3 line segments and a semi-circle.

Round 3: The graph above is the function $f(x)$ and consists of 3 line segments and a semi-circle.

a) If $\int_{-6}^{10} f(x)dx = 12$, find $\int_{6}^{10} f(x)dx$

b) Evaluate $\int_{2}^{4}(3f'(x) + 5)dx$

c) Find $\lim_{x\to 5} \frac{2^{(x-5)}+3f\prime(x)}{f"(x)+\arcsin(x-4)}$.

d) The function g is given by $g(x) = \int_{-3}^{x} f(t)dt$. Find the values of $g(4)$, $g'(4)$ and $g"(4)$ or explain why the value fails to exist.

e) The function h is given by $h(x) = x^3 \cdot \int_{0}^{2x} f(t)dt$. Find $h'(2)$.