1. State the definition of the derivative of a function $f(x)$ at $x = a$.

2. Let $f(x) = 5x^2 - 3x$.

(a) Use the **definition** to find the derivative of $f(x)$.

(b) Find the slope of the tangent line to $f(x)$ when $x = -3$.

(c) Write the equation of the line tangent to $f(x)$ when $x = -3$.

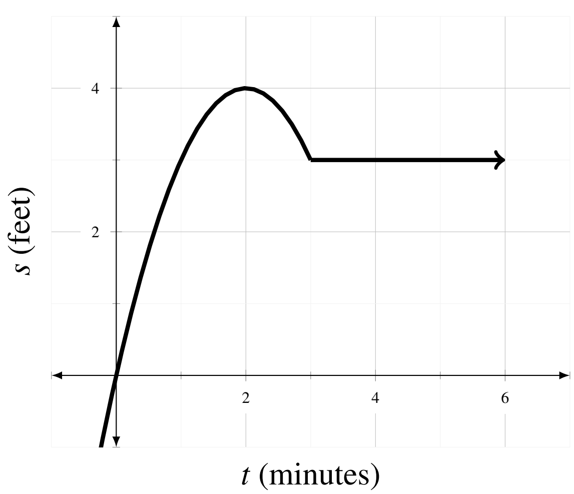
3. Suppose N represents the number of people in the United States who travel by car to another state for a vacation this Memorial Day weekend when the average price of gasoline is p dollars per gallon.

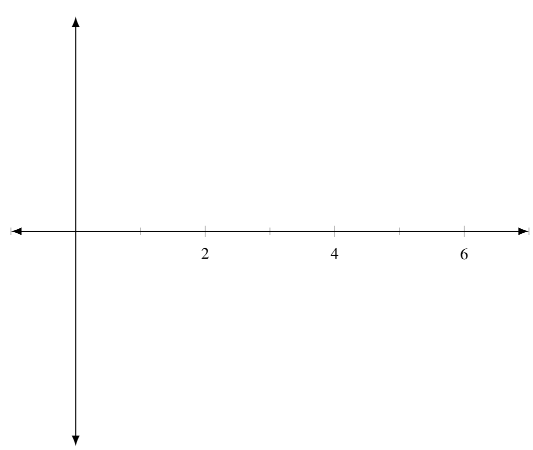
(a) What are the units of $N'(p)$?

(b) In the context of the problem, write a sentence interpreting $N'(p)$.

(c) Would you expect $N'(p)$ to be positive or negative? Explain your answer.

4. The graph of $f(x)$ is sketched below. On the separate set of axes, give a rough sketch of $f'(x)$.





5. Find the domain of each function.

(a) $f(x) = \sqrt{x^2 - x - 6}$

(b) $g(t) = \ln(t + 6)$

6. State the definition of "The function $f(x)$ is continuous at $x = a$".

7. Suppose

$$f(x) = \begin{cases} -\frac{2}{x} & x < 2 \\ \frac{x}{x-3} & x \geq 2 \end{cases}$$

Is $f(x)$ continuous at $x = 0$? At $x = 2$? Justify your answers using the definition of continuity.

8. Find the limit or show that it does not exist. *Make sure you are writing your mathematics correctly and clearly.*

(a) $\displaystyle\lim_{x\to\infty} \frac{10^x - 1}{3 - 10^x}$

(b) $\displaystyle\lim_{x\to\infty} \frac{\sqrt[3]{8x^3 + 1}}{2 - 5x}$

(c) $\displaystyle\lim_{r\to 16^-} \frac{\sqrt{r}}{(r - 16)^3}$

(d) $\displaystyle\lim_{x\to -3} \frac{x^2 - 9}{x^2 + 2x - 3}$

9. Consider a function with vertical asymptotes at $x = -1$ and $x = 3$ and a horizontal asymptote at $y = 4/3$.

(a) Write a formula for such a function.

(b) Sketch the graph of the function.

(c) Use limits to demonstrate that your function really does have a vertical asymptote at $x = -1$

(d) Use limits to demonstrate that your function really does have a horizontal asymptote at $y = 4/3$.

10. Solve for x.

(a) $e^{x-3} + 2 = 6$

(b) $\ln(x + 5) - 3 = 7$

(c) $\ln x + \ln(x - 1) = 0$

(d) $\cos(8x) = 0$

11. Use the Intermediate Value Theorem to show $\ln x = x - 5$ has a solution. (Hint: Show there is a solution in the interval $[1, e^5]$.)

12. Sketch each of the functions below. Label all x- and y-intercepts and asymptotes. State, in interval notation, the domain and range of each function next to its graph.

(a) $y = 6 - x^4$

(b) $y = \sin(2x)$

(c) $y = \tan x$

(d) $y = \tan^{-1} x$

(e) $y = e^{x-1} + 2$

(f) $y = \ln x$

(g) $y = -2/(x + 3)$

(h) $y = \sqrt{x + 5}$