Name _____ Test 2, Fall 2017

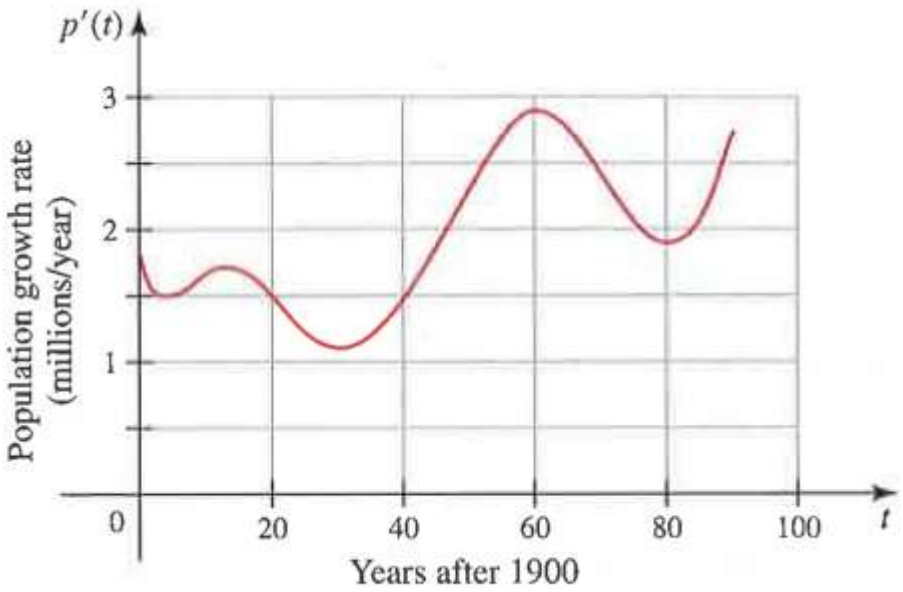
1) A mosquito is flying around a yard, and its distance from a gardener in the yard is given by $s(t) = -2t^3 + 15t + 5$ where s is given in inches and t in seconds. How fast is the mosquito moving after 1 second?

(5 points)

2) Find $\frac{dy}{dx}$ when $\sin(xy) = x^2$

(6 points)

Let $p(t)$ be the population in the United States, in millions, after the year 1900. So for example $t = 32$ represents the year 1932. A graph of $p'(t)$ between 1900 and 1990 is shown below. Use this for the next THREE questions.



3) When was the population increasing?
(4 points)

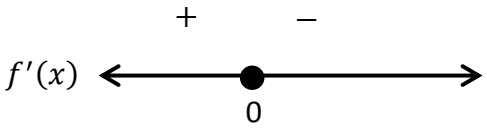
4) When was the rate of change of the population increasing?
(4 points)

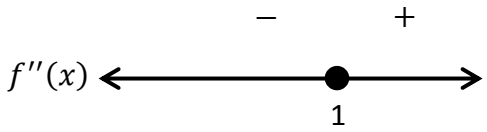
5) When on the graph was the population the largest?
(3 points)

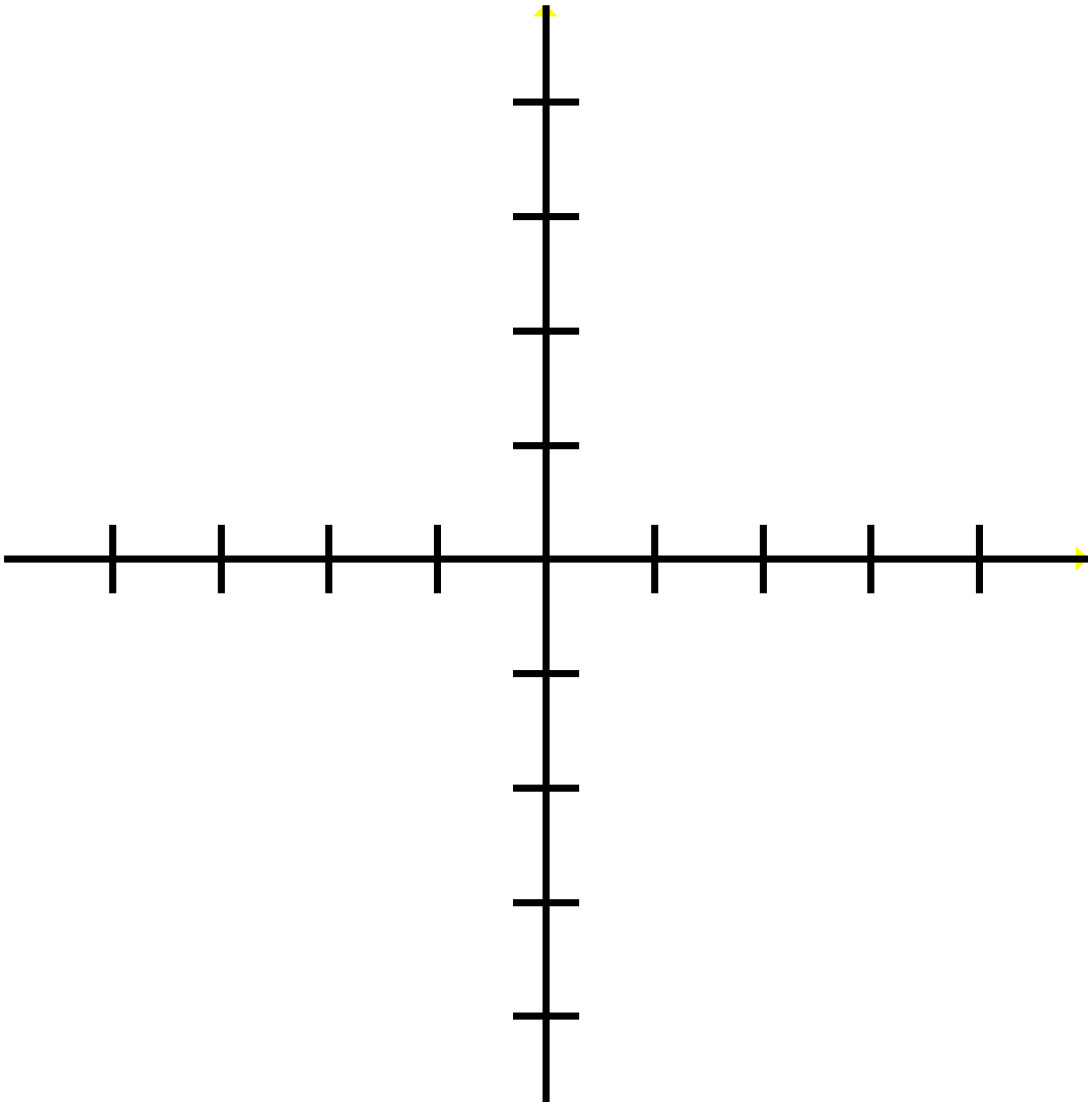
6) The edges of a cube increase at a rate of 2cm/s. How fast is the volume changing when the length of each edge is 5m?
(8 points)

7) Two boats leave a port at the same time; one travels west at 6mi/hr and the other travels south at 8mi/hr. At what rate is the distance between them changing 30 minutes after they leave the port? (10 points)

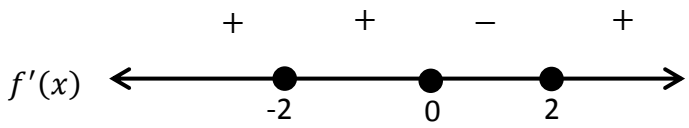
8) Sketch a continuous and differentiable function that satisfies the sign charts below.
(4 points)

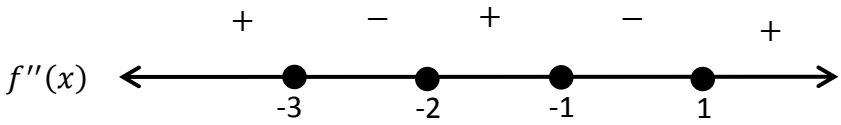


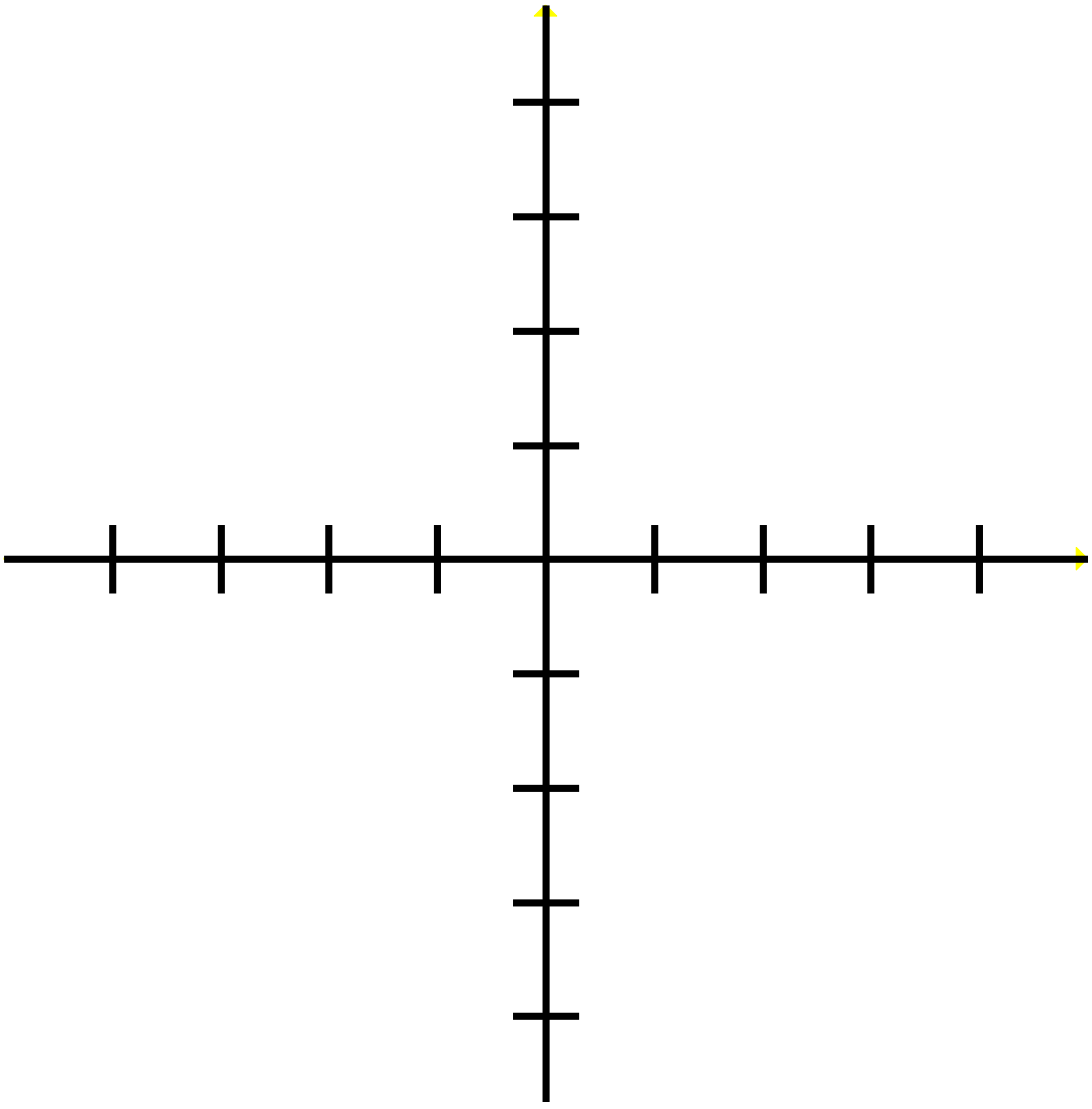




9) Sketch a continuous and differentiable function that satisfies the sign charts below.
(4 points)



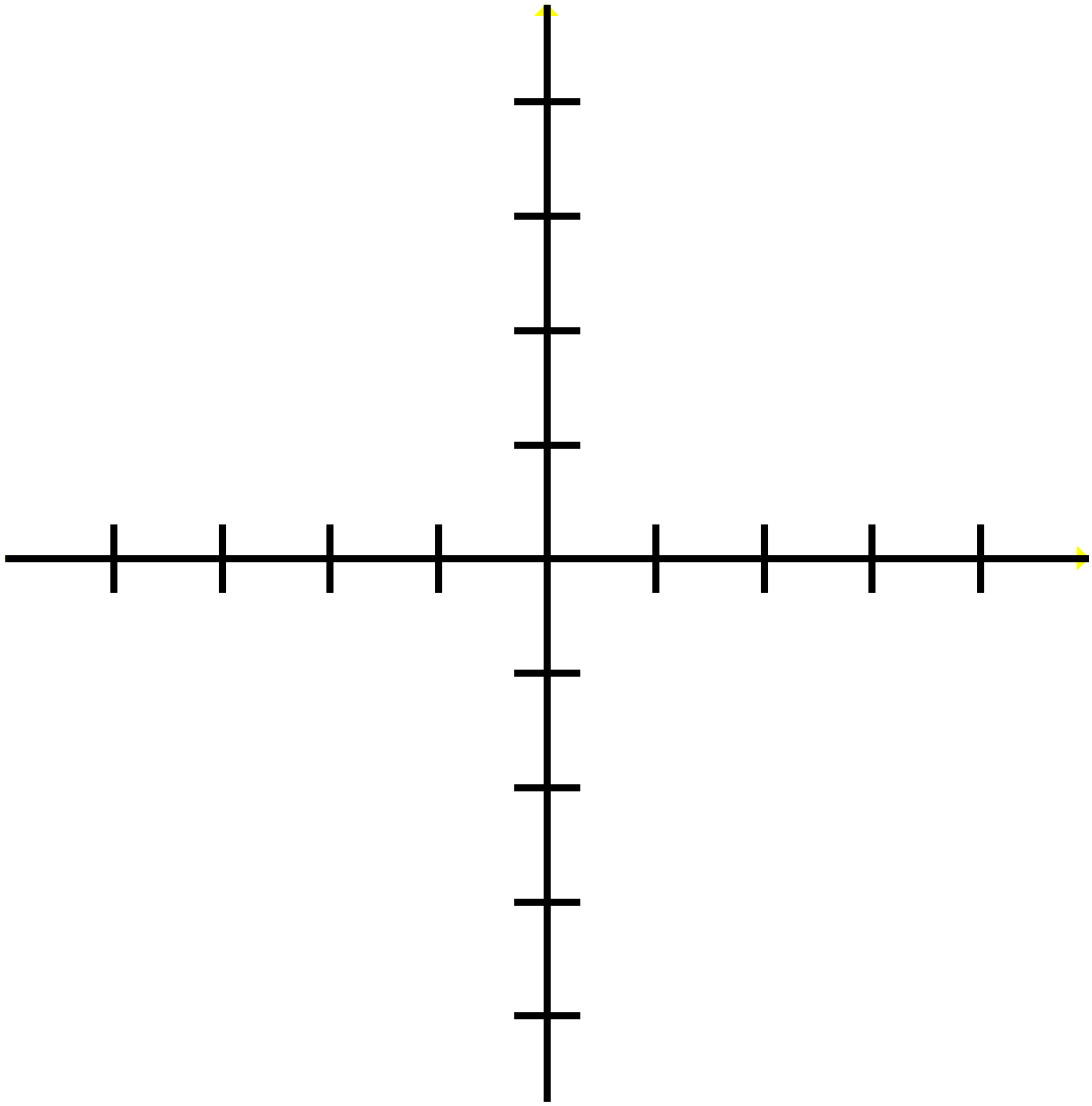




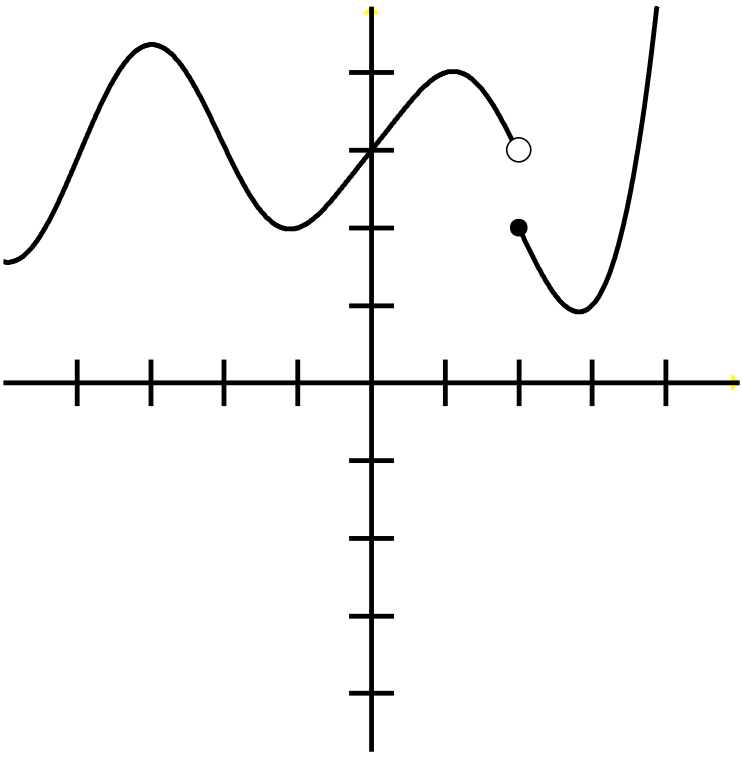
10) Sketch a continuous and differentiable function that has no asymptotes and is defined on $[-3,4]$ that satisfies:

- There is a local minimum at $x = -3$.
- There is an absolute maximum at $x = -1$.
- There is a relative minimum at $x = 2$.
- There is an absolute minimum at $x = 4$.
- The absolute maximum is $y = 3.5$.

(6 points)



Use the graph below to answer the questions on this page.



11) Find all minimizers of the function.
(4 points)

12) Find all relative maximum values of the function.
(4 points)

13) Find all x-values where the function changes concavity.
(4 points)

14) Approximate $f(1)$
(4 points)

15) Approximate $f'(1)$.
(4 points)

16) Approximate $f''(1)$.
(4 points)

17) Find the limit below.

$$\lim_{x \to 5} \frac{\sqrt{x-4}-1}{3x-15}$$

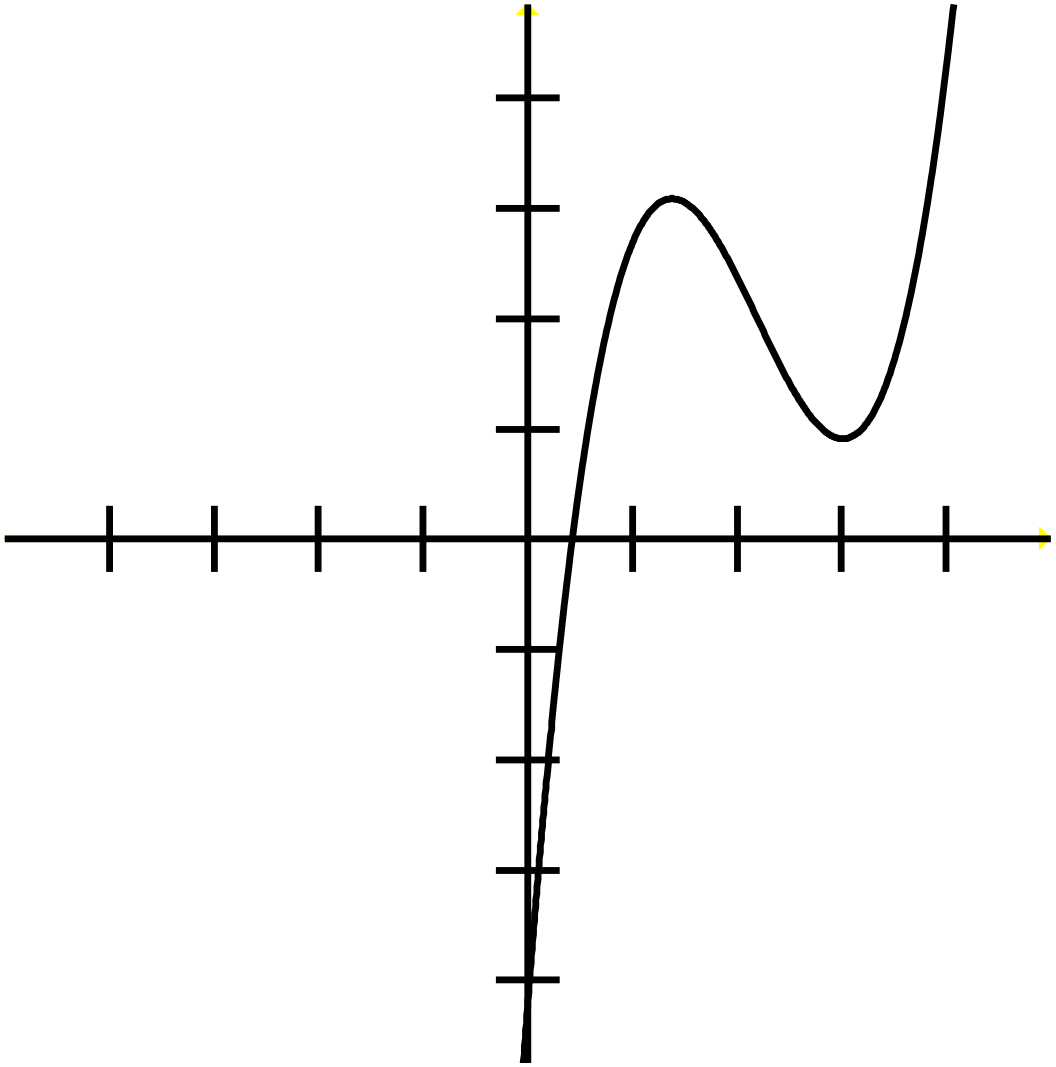
(6 points)

18) Find $\frac{d}{dx}\cot^2(x^3)$

(4 points)

19) On the graph below, suppose we think that a root of the function is at $x = 1$. Use Newton's method to graphically find a better solution.

(6 points)



20) Find the limit below.

$$\lim_{x \to e} \frac{\ln(x) - 1}{x - e}$$

(6 points)