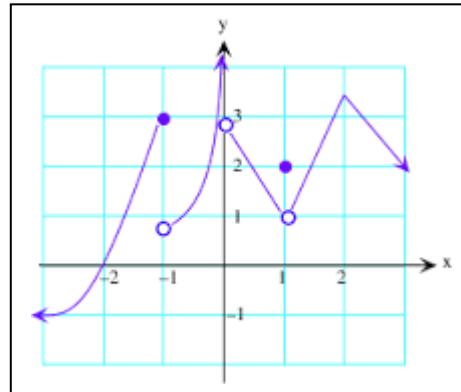


Midterm exam, MTH-202, Fall 2017 (practice test)

1. a) From the given graph, state the numbers at which the function is discontinuous and explain why.

b) From the given graph, find $\lim_{x \rightarrow 2} f(x)$, $\lim_{x \rightarrow 1} f(x)$, $\lim_{x \rightarrow -1^-} f(x)$.



2. a) Define the derivative $f'(a)$.
 b) Discuss two ways of interpreting this number.
 c) Use the definition of the derivative to find $f'(2)$ if $f(x) = 2x^2 - 3x + 1$
 d) Find the equation of the tangent line to $y = f(x)$ at $x = 2$

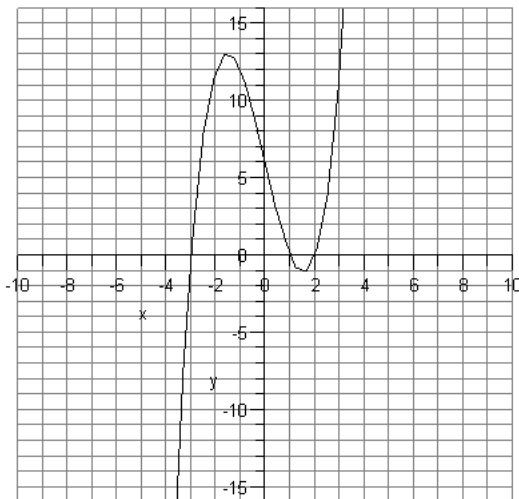
3. Sketch the graph of a function $y = f(x)$ that satisfies all of the given conditions:

$$\lim_{x \rightarrow 2} f(x) = \infty, \lim_{x \rightarrow \infty} f(x) = 2, \lim_{x \rightarrow -\infty} f(x) = -1.$$

4. Find a) $\lim_{x \rightarrow \infty} \frac{2x^2 - 3x + 1}{3x^2 + 5x - 2}$ b) $\lim_{x \rightarrow 2^-} \frac{3x - 1}{(x - 2)^3}$

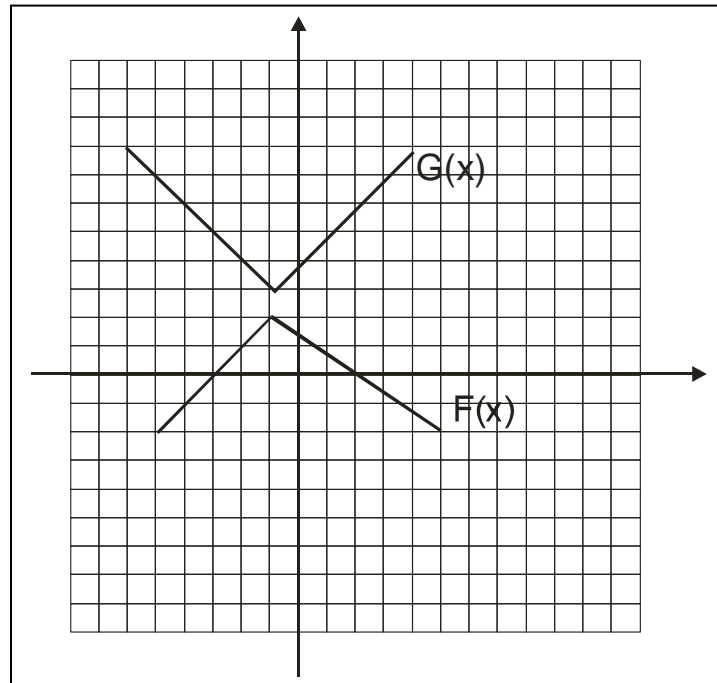
5. The graph of the derivative f' of a continuous function f is shown.

- a) On what intervals is f increasing or decreasing?
 b) At what values of x does f have a local maximum or minimum?
 c) On what intervals is f concave upward or downward?
 d) State the x -coordinate(s) of the point(s) of inflection.
 e) Assuming that $f(0) = 1$, sketch a graph of f .



6. Sketch the graph of a function that satisfies all of the given conditions: $f'(0) = f'(4) = 0$, $f'(x) > 0$ if $x < 0$, $f'(x) < 0$ if $0 < x < 4$ or if $x > 4$, $f''(x) > 0$ if $2 < x < 4$, $f''(x) < 0$ if $x < 2$ or $x > 4$.

7. A particle moves according to a law of motion $s(t)=t^3-12t^2+36t-20$, $t \geq 0$, where t is measured in seconds and s in meters.
- Find the velocity at time t .
 - When is the particle at rest?
 - When is the particle moving forward?
 - Find the total distance traveled during the first 7 seconds.
 - Find the acceleration at time t .
 - When is the particle speeding up?
8. If $F(x)$ and $G(x)$ are the functions whose graphs are shown, let $P(x) = F(x)G(x)$, $Q(x) = F(x)/G(x)$. Find $P'(-2)$, $Q'(-2)$.



9. Differentiate each of the given functions. Do not simplify.

a) $y = x^5 e^x$

b) $y = \frac{3x^3 - 2x^2 - 6}{7x^5 + 1}$

c) $y = 7x^8 + 4x^5 - x^3 + 4$