1) Let $f(x) = (x^7 - 15x^2 + 3) \cdot (2x^4 + 2x)$. Find $f'(x)$.

(6 points)

2) Let $(x) = \dfrac{(x^7 - 15x^2 + 3)}{(2x^4 + 2x)}$. Find $f'(x)$.

(6 points)

3) Find $\frac{d}{dx}(\sin(x))$.

(6 points)

4) Find $\frac{d}{dx}(7^x)$.

(6 points)

5) Find the four-hundredth derivative of $y = x^4$.

(4 points)

6) Find the four-hundredth derivative of $y = \sin(x)$.

(4 points)

7) Find the four-hundredth derivative of $y = 7^x$.

(4 points)

A table of values is given below for the function $f(x) = \frac{4x^2 - 13x - 12}{x - 4}$

x	$f(x)$	x	$f(x)$
3.5	17	4.5	21
3.9	18.6	4.1	19.4
3.99	18.96	4.01	19.04
3.999	18.996	4.001	19.004

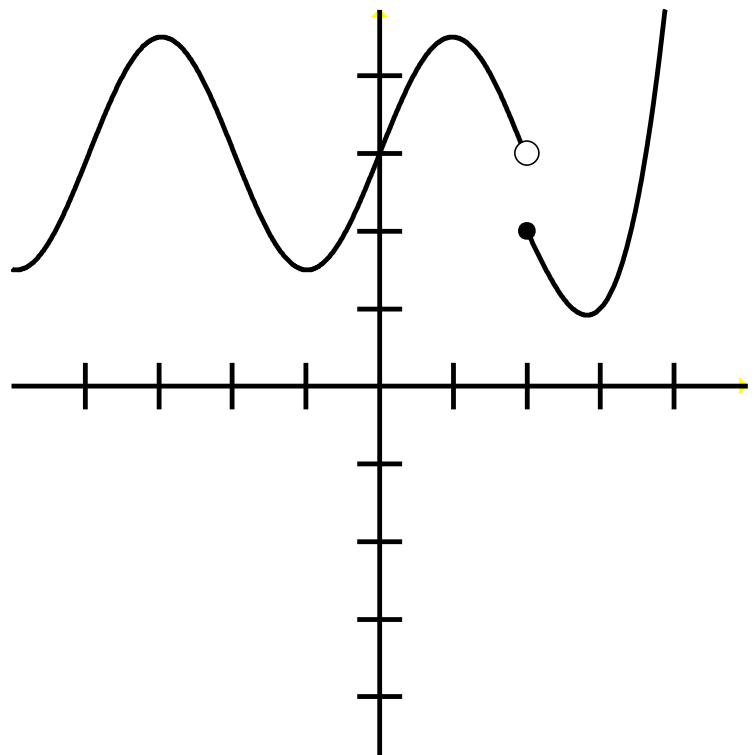8) What would you guess the value of the limit is?
(4 points)

9) In the previous question you guessed the value of a limit. What limit did you guess?
(Your answer should be an equation with proper limit notation on one side and your answer to #8 on the other)
(4 points)

10) The graph to the right is the graph of $y = f(x)$.
On the same graph, sketch the derivative $y = f'(x)$.
(6 points)

Use the graph to the right to complete the following FIVE questions.

11) Estimate the derivative of $y = f(x)$ at $x = -2$.
(4 points)

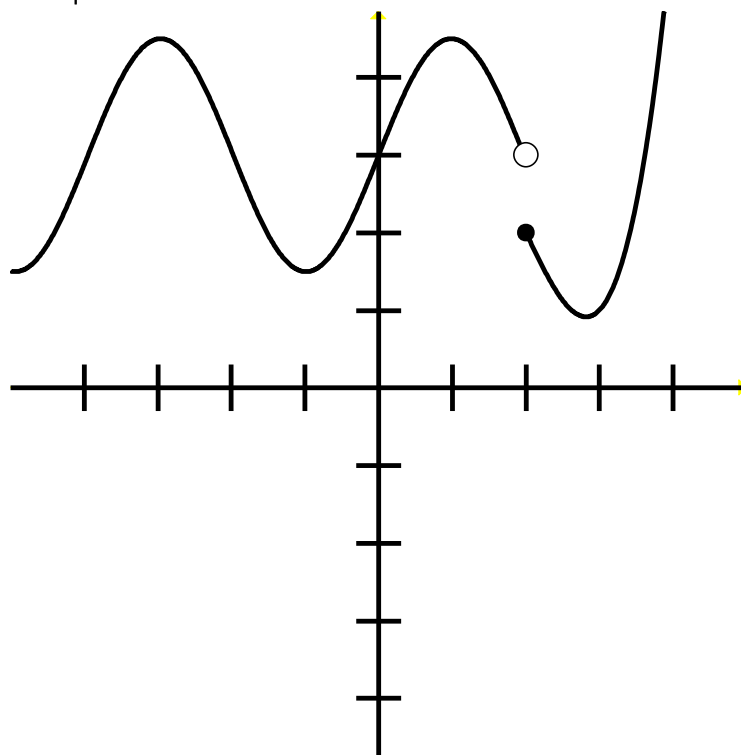12) Sketch the tangent line to f at $x = -2$.
(4 points)

13) Why is f not continuous at $x = 2$?
(4 points)

14) Why is f not differentiable at $x = 2$?
(4 points)

15) Calculate the limits below.
(6 points)

$$\lim_{x \to 2^-} f(x)$$

$$\lim_{x \to 2^+} f(x)$$

$$\lim_{x \to 2} f(x)$$

16) State the formal definition of the derivative.
(4 points)

17) Complete ONE of the following problems. (6 points)
    A) Use your formal definition to find $f'(x)$ for $f(x) = 3x^2$.
    B) Explain, using the formal definition, why it calculates the slope of the tangent line.

Calculate the following limits. (6 points each)

18) $\lim\limits_{x \to 2^+} \dfrac{2x^2 - 8x + 8}{(x-2)^2(x+3)(x-4)^2}$

19) $\lim\limits_{x \to \infty} \dfrac{2x^2 - 8x + 8}{(x-2)^2(x+3)(x-4)^2}$

20) $\lim\limits_{x \to 3^-} \dfrac{(x-4)^2}{(x-3)}$