

Math 180 Unit 3 (chapter 5) Review

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

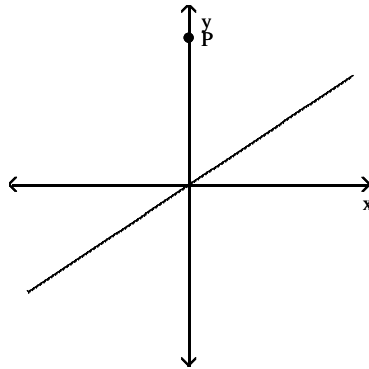
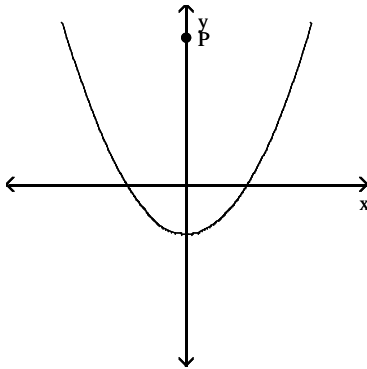
The graphs of the first and second derivatives of a function $y = f(x)$ are given. Select a possible graph of f that passes through the point P. (NOTE: Vertical scales may vary from graph to graph.)

1)

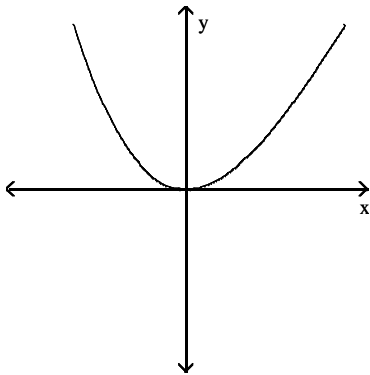
f'

f''

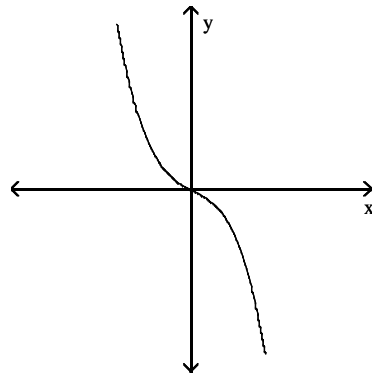
1) _____



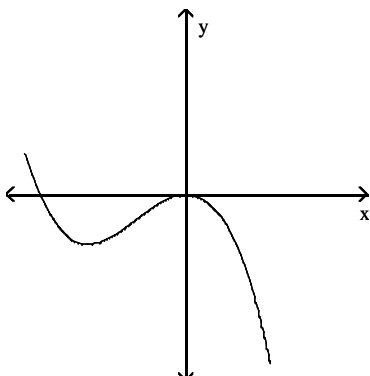
A)



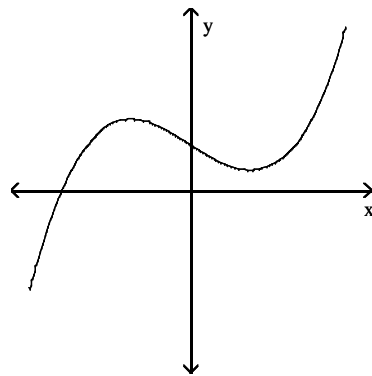
B)



C)



D)



SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Decide if the given value of x is a critical number for f , and if so, decide whether the point for x on f is a relative minimum, relative maximum, or neither.

2) $f(x) = (x + 6)^4$; $x = -6$

2) _____

Find the domain and intercepts.

3) $g(x) = \frac{2x}{x+3}$

3) _____

Find the limit, if it exists.

4) Find $\lim_{x \rightarrow \infty^+} \frac{x^2}{e^x}$.

4) _____

5) Find $\lim_{x \rightarrow \infty^+} \frac{\ln x}{x}$.

5) _____

6) $\lim_{x \rightarrow \infty} \frac{3x - 6x^2 + 2x^3}{7 - 2x - x^3}$

6) _____

7) $\lim_{x \rightarrow -\infty} \frac{2x^3 + 4x^2}{5x^2 - x}$

7) _____

Provide an appropriate response.

8) Sketch the graph of $f(x) = \frac{2x^2 + 5x - 3}{x^2 - 9}$. Include sketch of all asymptotes.

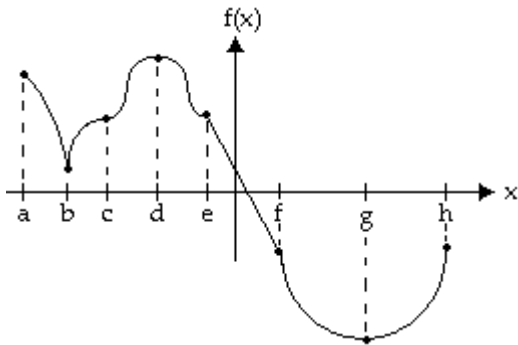
8) _____

9) Sketch the graph of $f(x) = x + \frac{3}{x^2}$. Include sketch of all asymptotes.

9) _____

10) Identify the intervals where $f(x)$ is increasing.

10) _____



11) Find two numbers whose sum is 340 and whose product is a maximum.

11) _____

12) Determine the intervals for which the function $f(x) = x^3 + 18x^2 + 2$, is decreasing.

12) _____

13) Find the absolute maximum and minimum values of $f(x) = 9x^3 - 54x^2 + 81x + 13$ on the interval $[-6, 2]$.

13) _____

14) Find the relative extrema of the function. List your answer(s) in terms of ordered pair(s). 14) _____

$$f(x) = \frac{8}{x^2 + 1}$$

15) Find two numbers whose difference is 12 and whose product is a minimum. 15) _____

16) Find vertical asymptotes for $f(x) = \frac{7x - 2}{x^2 - 3x - 4}$. 16) _____

17) Find the inflection point(s) for $f(x) = x^3 - 6x - 1$. 17) _____

18) Use the first derivative test to determine the local extrema, if any, for the function: 18) _____

$$f(x) = 3(x - 4)^{2/3} + 6.$$

19) Find $f''(x)$ for $f(x) = -7x^9 + 5x^2$. 19) _____

Sketch a graph of a single function that has these properties.

20) a) Continuous for all real numbers 20) _____

b) Differentiable everywhere except $x = 0$

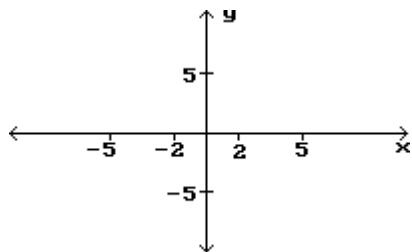
c) $f'(x) < 0$ on $(-\infty, 0)$

d) $f'(x) > 0$ on $(0, \infty)$

e) $f''(x) < 0$ on $(-\infty, 0)$ and $(0, \infty)$

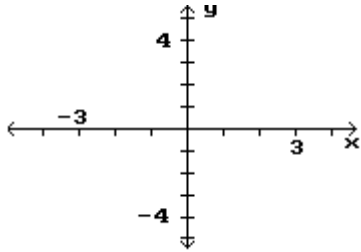
f) $f(-2) = f(2) = 5$

g) y-intercept and x-intercept at $(0, 0)$



- 21) a) Continuous and differentiable for all real numbers
 b) $f'(x) > 0$ on $(-3, -1)$ and $(2, \infty)$
 c) $f'(x) < 0$ on $(-\infty, -3)$ and $(-1, 2)$
 d) $f''(x) > 0$ on $(-\infty, -2)$ and $(1, \infty)$
 e) $f''(x) < 0$ on $(-2, 1)$
 f) $f'(-3) = f'(-1) = f'(2) = 0$
 g) $f''(x) = 0$ at $(-2, 0)$ and $(1, 1)$

21) _____



Solve the problem.

- 22) A company wishes to manufacture a box with a volume of 32 cubic feet that is open on top and is twice as long as it is wide. Find the width of the box that can be produced using the minimum amount of material. Round to the nearest tenth, if necessary.

22) _____

- 23) The average manufacturing cost per unit (in hundreds of dollars) for producing x units of a product is given by:
 $\bar{C}(x) = 2x^3 - 42x^2 + 288x + 12, \quad 1 \leq x \leq 5$
 At what production level will the average cost per unit be maximum?

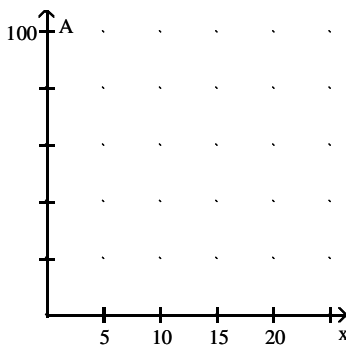
23) _____

- 24) The annual revenue and cost functions for a manufacturer of zip drives are approximately $R(x) = 520x - 0.02x^2$ and $C(x) = 160x + 100,000$, where x denotes the number of drives made. What is the maximum annual profit?

24) _____

- 25) Suppose that the total-cost function for a certain company to produce x units of a product is given by $C(x) = 6x^2 + 30$. Graph the average cost function $A(x) = C(x)/x$.

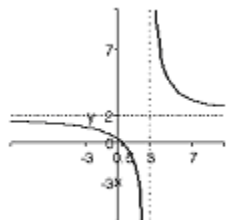
25) _____



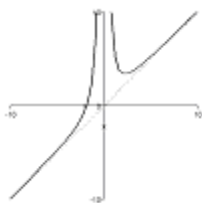
Answer Key

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- 1) D
- 2) Critical number; minimum at $(-6, 0)$
- 3) Domain: All real numbers except -3 ; y intercept: 0 ; x intercept: 0
- 4) 0
- 5) 0
- 6) -2
- 7) $-\infty$
- 8)

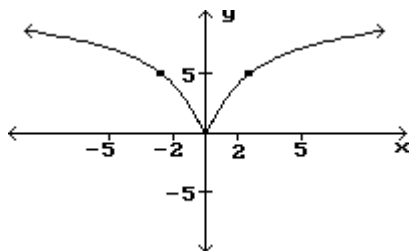


9)



- 10) (b, d), (g, h)
- 11) 170 and 170
- 12) $(-12, 0)$
- 13) $\max f(x) = f(1) = 49$
 $\min f(x) = f(-6) = -4361$

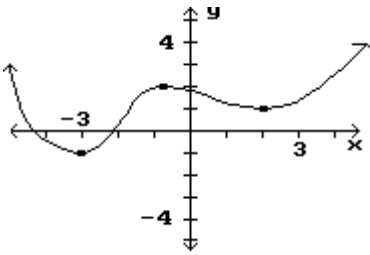
- 14) Relative maximum: $(0, 8)$
- 15) 6 and -6
- 16) $x = -1, x = 4$
- 17) $(0, -1)$
- 18) $f(x)$ has a local minimum at $x = 4$.
- 19) $f'(x) = -504x^7 + 10$
- 20)



Answer Key

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21)



22) 2.9 ft

23) 5 units

24) \$1,520,000

25)

