Name: Last ____________________. First ____________________

You must show your work and/or provide explanations for your answers for all questions. Otherwise, no credit will be given.

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

Find the absolute extreme values of each function on the interval.

1) $f(x) = e^x - x, -1 \le x \le 2$ 1) ________

A) Minimum value is $e^{-1} + 1$ at $x = -1$; maximum value is $e^2 - 2$ at $x = 2$
B) Minimum value is 1 at $x = 0$; no maximum value
C) Minimum value is 1 at $x = 0$; maximum value is $e^2 - 2$ at $x = 2$
D) Minimum value is 1 at $x = 0$; maximum value is $e^{-1} + 1$ at $x = -1$

Find the extreme values of the function and where they occur.

2) $y = x^3 - 3x^2 + 1$ 2) ________

A) Local maximum at (0, 1).
B) Local minimum at (2, –3).
C) Local maximum at (0, 1), local minimum at (2, –3).
D) None

Find the derivative at each critical point and determine the local extreme values.

3) $y = \begin{cases} 3 - x, & x < 0 \\ 3 + 2x - x^2, & x \ge 0 \end{cases}$ 3) ________

A)

Critical Pt.	derivative	Extremum	Value
x = 0	undefined	local min	–3
x = 1	0	local max	2

B)

Critical Pt.	derivative	Extremum	Value
x = 0	undefined	local min	3
x = 1	0	local max	4

C)

Critical Pt.	derivative	Extremum	Value
x = 3	undefined	local min	3
x = 0	0	local max	4

D)

Critical Pt.	derivative	Extremum	Value
x = 0	undefined	local min	3
x = 2	0	local max	7

Find the value or values of c that satisfy the equation

$$\frac{f(b) - f(a)}{b - a} = f'(c)$$

in the conclusion of the Mean Value Theorem for the given function and interval.

4) $f(x) = x^2 + 4x + 2$, $[-3, -2]$. 4) ________

A) $0, -\frac{5}{2}$ B) $-\frac{5}{2}, \frac{5}{2}$ C) $-\frac{5}{2}$ D) $-3, -2$

Using the derivative of f(x) given below, determine the intervals on which f(x) is increasing or decreasing.

5) $f'(x) = x^{1/3}(x - 5)$ 5) ________

A) Decreasing on $(-\infty, 0) \cup (5, \infty)$; increasing on $(0, 5)$
B) Decreasing on $(0, 5)$; increasing on $(5, \infty)$
C) Decreasing on $(0, 5)$; increasing on $(-\infty, 0) \cup (5, \infty)$
D) Increasing on $(0, \infty)$

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

For the given function:
(a) Find the intervals on which the function is increasing and decreasing.
(b) Then identify the function's local extreme values, if any, saying where they are taken on.
(c) Which, if any, of the extreme values are absolute?

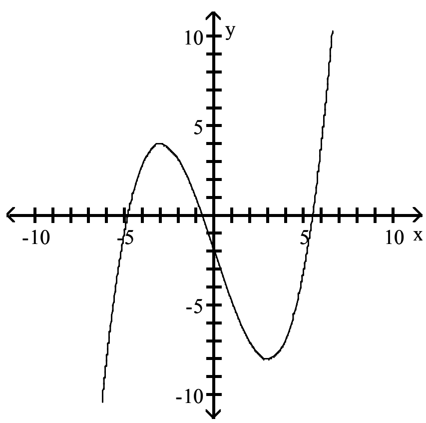
6) $k(x) = x^3 - 48x$ 6) ________________

7) $f(x) = xe^{-x/3}$ 7) ________________

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

Use the graph of the function f(x) to locate the local extrema and identify the intervals where the function is concave up and concave down.

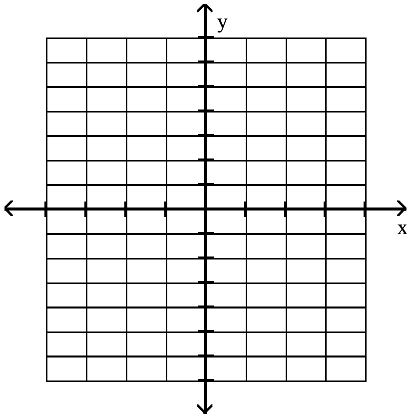
8) 8) ________



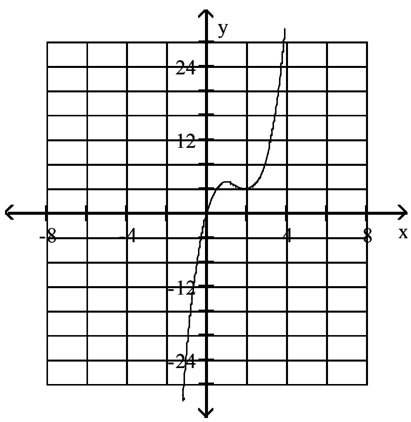
A) Local minimum at x = 3 ; local maximum at x = –3 ; concave up on $(0, \infty)$; concave down on $(-\infty, 0)$
B) Local minimum at x = 3 ; local maximum at x = –3 ; concave down on $(-\infty, -3)$ and $(3, \infty)$; concave up on $(-3, 3)$
C) Local minimum at x = 3 ; local maximum at x = –3 ; concave up on $(-\infty, -3)$ and $(3, \infty)$; concave down on $(-3, 3)$
D) Local minimum at x = 3 ; local maximum at x = –3 ; concave down on $(0, \infty)$; concave up on $(-\infty, 0)$

Sketch the graph and show all local extrema and inflection points.

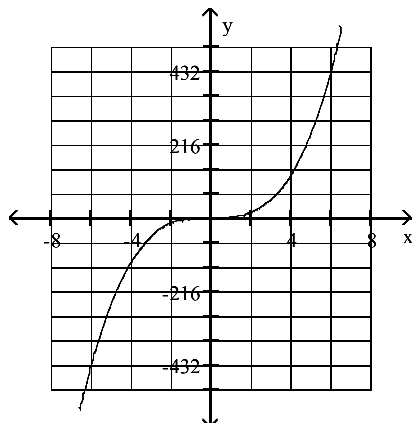
9) $y = 2x^3 - 9x^2 + 12x$ 9) ________



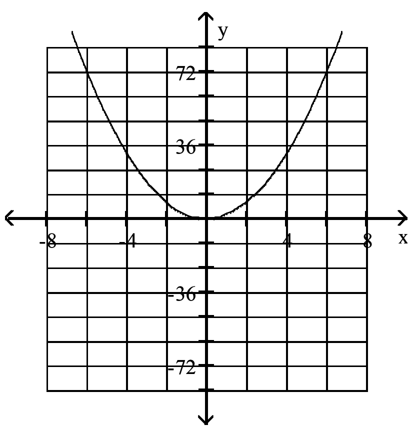
A) Local max: $(1,5)$, min: $(2,4)$
Inflection point: $\left(\frac{3}{2}, \frac{9}{2}\right)$



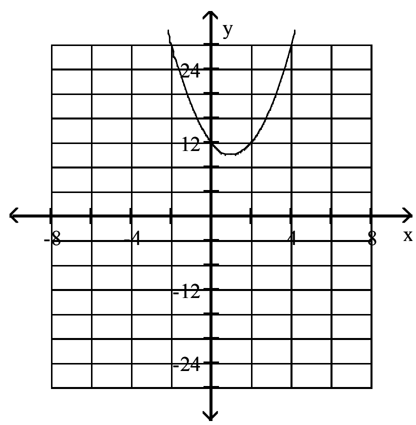
B) Local maximum: $(0, 0)$
Local minimum: $(0,0)$
Inflection point: $(0,0)$



C) No extrema
Inflection point: $(0, 0)$



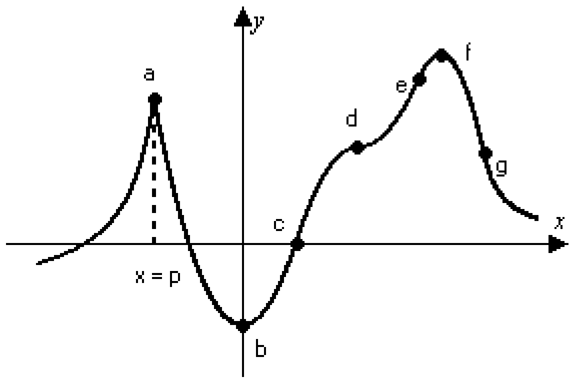
D) Local min: $(1,10)$
No inflection point



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

Solve the problem.

10) The accompanying figure shows a portion of the graph of a function that is twice−differentiable at all x except at $x = p$. At each of the labeled points, classify y' and y'' as positive, negative, or zero. 10) _______________



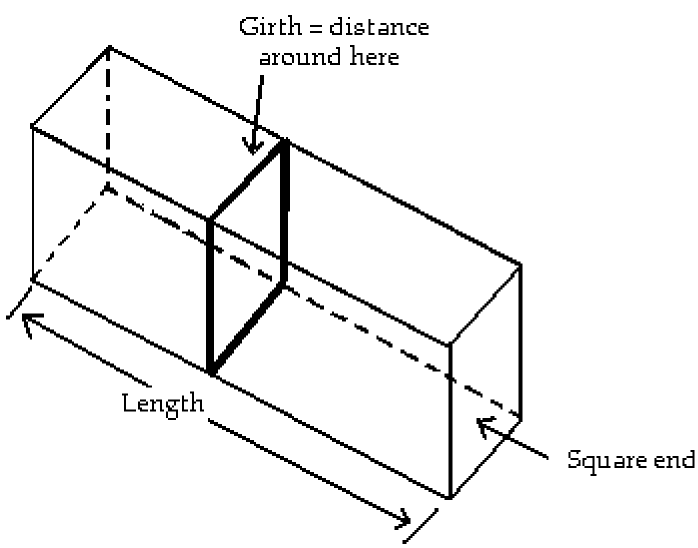
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

11) Find two positive numbers whose sum is 16 such that the product of one number and the cube of the other number is a maximum. 11) _______

A) 4 and 12 B) 3 and 13 C) 9 and 7 D) 8 and 8 E) 1 and 15

Solve the problem.

12) A private shipping company will accept a box for domestic shipment only if the sum of its length and girth (distance around) does not exceed 102 in. What dimensions will give a box with a square end the largest possible volume? 12) _______

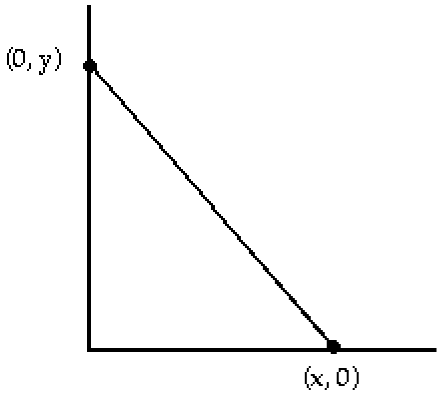


A) 17 in. x 17 in. x 34 in. B) 17 in. x 17 in. x 85 in.

C) 17 in. x 34 in. x 34 in. D) 34 in. x 34 in. x 34 in.

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

13) You are planning to close off a corner of the first quadrant with a line segment 19 units long running from (x,0) to (0,y). Show that the area of the triangle enclosed by the segment is largest when $x = y$. 13) ______________



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

14) A rectangular enclosure subdivided into four pens by three parallel partitions is to be built using a total of 500 m of fencing. What dimensions will maximize the total area of the pens? 14) _______

A) 60 m and 120 m
B) 28 m and 180 m
C) 45 m and 183 m
D) 40 m and 150 m
E) 50 m and 125 m

Solve the problem.

15) A rectangular field is to be enclosed on four sides with a fence. Fencing costs \$7 per foot for two opposite sides, and \$3 per foot for the other two sides. Find the dimensions of the field of area 620 ft^2 that would be the cheapest to enclose. 15) _______

A) 38 ft @ \$7 by 16.3 ft @ \$3
B) 16.3 ft @ \$7 by 38 ft @ \$3
C) 58.1 ft @ \$7 by 10.7 ft @ \$3
D) 10.7 ft @ \$7 by 58.1 ft @ \$3

16) Find the number of units that must be produced and sold in order to yield the maximum profit, given the following equations for revenue and cost: 16) _______

$R(x) = 70x - 0.5x^2$
$C(x) = 9x + 10.$

A) 61 units
B) 79 units
C) 62 units
D) 71 units

Use l'Hôpital's rule to find the limit.

17) $\lim\limits_{x \to 0} \dfrac{\sin 2x}{\tan 4x}$ 17) _______

A) 0
B) $\frac{1}{2}$
C) 2
D) $-\frac{1}{2}$

Use l'Hopital's Rule to evaluate the limit.

18) $\lim\limits_{x \to \infty} \dfrac{16x^2 - 8x - 6}{18x^2 - 6x + 8}$ 18) _______

A) $\dfrac{9}{8}$ B) $-\dfrac{8}{9}$ C) 1 D) $\dfrac{8}{9}$

19) $\lim\limits_{x \to 0} \dfrac{\cos 7x - 1}{x^2}$ 19) _______

A) $-\dfrac{49}{2}$ B) $\dfrac{7}{2}$ C) 0 D) $\dfrac{49}{2}$

Find the most general antiderivative.

20) $\int (5x^3 - 5x + 2)\, dx$ 20) _______

A) $\dfrac{5}{4}x^4 - \dfrac{5}{2}x^2 + 2x + C$ B) $15x^2 - 5 + C$

C) $15x^4 - 10x^2 + 2x + C$ D) $5x^4 - 5x^2 + 2x + C$

Solve the problem.

21) Given the acceleration, initial velocity, and initial position of a body moving along a coordinate line at time t, find the body's position at time t. 21) _______
$a = 18$, $v(0) = -7$, $s(0) = 3$

A) $s = 9t^2 - 7t + 3$ B) $s = 18t^2 - 7t + 3$ C) $s = -9t^2 + 7t + 3$ D) $s = 9t^2 - 7t$

Find the most general antiderivative.

22) $\int \dfrac{x\sqrt{x} + \sqrt{x}}{x^2}\, dx$ 22) _______

A) $\dfrac{2}{\sqrt{x}} - 2\sqrt{x} + C$ B) $-\dfrac{\sqrt{x}}{2} - \dfrac{3\sqrt{x}}{2} + C$

C) $2\sqrt{x} - \dfrac{2}{\sqrt{x}} + C$ D) C

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

23) **A Rocket With Warp Drive!** On Earth, the acceleration of gravity is -32 ft/sec/sec. A rocket is launched at $t = 0$ from the ground ($s = 0$) and a high tech WARP DRIVE is turned on at $t = 0$ that imparts an acceleration of $+42$ ft/sec/sec, thus overcoming gravity and yielding a net acceleration of $+10$ ft/sec/sec at $t = 0$. An initial velocity of 1000 ft/sec is also imparted by the Warp Drive. Write an equation for the velocity $v(t)$ and the position $s(t)$. What is the position of the rocket in miles (round to nearest mile) after one day? (24 hours, 3600 seconds per hour, 5280 feet per mile.. 23) _______________

Answer Key
Testname: MATH1540-Q3-PRACTICE-UPDATED

1) C
2) C
3) B
4) C
5) C
6) (a) increasing on $(-\infty, -4)$ and $(4, \infty)$; decreasing at $(-4, 4)$
(b) local maximum at $x = -4$ $(-4, 128)$; local minimum at $x = 4$ $(4, -128)$
(c) no absolute extrema
7) (a) increasing on $(-\infty, 3)$; decreasing on $(3, \infty)$
(b) local maximum at $x = 3$ $\left(3, \frac{3}{e}\right)$
(c) no absolute extrema
8) A
9) A
10) a: both y' and y'' are undefined.
b: $y' = 0$ and $y'' > 0$
c: $y' > 0$ and $y'' = 0$
d: $y' = 0$ and $y'' = 0$
e: $y' > 0$ and $y'' = 0$
f: $y' = 0$ and $y'' < 0$
g: $y' < 0$ and $y'' = 0$
11) A
12) A
13) If x , y represent the legs of the triangle, then $x^2 + y^2 = 19^2$.
Solving for y, $y = \sqrt{361 - x^2}$

$A(x) = xy = x\sqrt{361 - x^2}$

$A'(x) = -\dfrac{x^2}{2\sqrt{361 - x^2}} + \dfrac{\sqrt{361 - x^2}}{2}$

Solving $A'(x) = 0$, $x = \pm \dfrac{19\sqrt{2}}{2}$

Substitute and solve for y: $\left(\dfrac{19\sqrt{2}}{2}\right)^2 + y^2 = 361$; $y = \dfrac{19\sqrt{2}}{2}$ $\therefore$ $x = y$.

14) E
15) B
16) A
17) B
18) D
19) A
20) A
21) A
22) C
23) $v(t) = 10t + 1000$, $s(t) = 5t^2 + 1000t$, 7,085,455 miles