Unit 3 Applications of Differentiation Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit Test Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part A Multiple Choice Questions:** Circle the correct answer.

1. If , then a point of inflection occurs at *x* =

(A) 11.693 (B) 9.128 (C) 7.867 (D) 6.597 (E) 5.272

1. Which of the following conditions would enable you to conclude that the graph of *f*  has a point of inflection at *x* = *c*?
2. *f ’’* (*c*) = 0
3. *f ’’* (*c*) does not exist
4. The sign of *f ’* changes at *x* = *c*.
5. *f*  is a cubic polynomial and *c* = 0.
6. There is a local minimum of *f ’* (*c*) at *x* = *c*.
7. The derivative of *g* is given by . On the interval [0, 3], at what value of *x* does *g* attain a relative maximum?

(A) 1 (B) 1.673 (C) 2 (D) 2.539 (E) no point

1. An 8 foot ladder is leaning against a wall. If the top of the ladder is sliding down the wall at 1 ft/s, how fast is the bottom of the ladder sliding away from the wall when the top is 4 ft from the ground?
2. ft/s
3. ft/s
4. ft/s
5. ft/s
6. ft/s



1. The graph of  is shown above. Which of the following could be a table of values for the derivative of , ?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (A) | (B) | (C) | (D) | (E) |
|

|  |  |
| --- | --- |
|  |  |
| -1 | 1/2 |
| 0 | 1/2 |
| 1 | 1/2 |

 |

|  |  |
| --- | --- |
|  |  |
| -1 | -1/3 |
| 30 | -1/2 |
| 1 | -1 |

 |

|  |  |
| --- | --- |
|  |  |
| -1 | 1/2 |
| 0 | 1/3 |
| 1 | 1/4 |

 |

|  |  |
| --- | --- |
|  |  |
| -1 | 1/4 |
| 0 | 1/3 |
| 1 | 1/2 |

 |

|  |  |
| --- | --- |
|  |  |
| -1 | -1 |
| 0 | -1/2 |
| 1 | -1/3 |

 |

1. A conical funnel has a base diameter of 4 cm and a height of 5 cm. The funnel is initially full, but water is draining at a constant rate of 2 cm3/s. What is the rate of change of the water level when the water is 2.5 cm high?
2. cm/s
3. cm/s
4. cm/s
5. cm/s
6. cm/s

18-21.

Let $p(x)$ be a continuous function on the interval [a, g] and differentiable on $\left(a,f\right)∪(f,g)$.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| $$x$$ | *a* | *b* | *c* | *d* | *e* | *f* | *g* |
| $$p^{'}(x)$$ | negative | zero | positive | zero | negative | undefined | positive |
| $$p^{''}(x)$$ | positive | positive | zero | negative | negative | undefined | negative |

Given the chart above for the first and second derivatives and assuming that the set {a, b, c, d, e, f, g} contains all of the critical points and all of the points at which inflection points occur, answer questions 18-21.

1. What are the critical points of $p(x)$ on [a, g]?

(A) b, c, d, f

(B) b, d, f

(C) b, c, d

(D) b, d

(E) f only

1. At what value(s) of *x* does a relative minimum occur?

(A) b only

(B) d only

(C) b and d

(D) b and f

(E) no relative minimum

1. On what interval(s) is $p(x)$ both decreasing and concave down?

 (A) (a, b) (B) (b, c) (C) (c, d) (D) (d, e) (E) (e, g)

1. At which point(s) does a point of inflection occur?

(A) b, d and f

(B) c only

(C) c and f

(D) b and d

(E) no point of infection

Unit 3 Applications of Differentiation Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Unit Test Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part B Free Response Question:** Show all work for the problem below.

The radius *r* of a sphere is increasing at a constant rate of 0.04 centimeters per second. (Note: The volume of a sphere with radius *r* is *V* = .

1. At the time when the radius of the sphere is 10 centimeters, what is the rate of the increase of its volume?
2. At the time when the volume of the sphere is 36π cubic centimeters, what is the rate of increase of the area of a cross section through the center of the sphere?
3. At the time when the volume and the radius of the sphere are increasing at the same numerical rate, what is the radius?