

Name: _____

Please read each question carefully to ensure that you are actually answering it. **Show all work.**
All numerical answers should be left in **exact** form unless otherwise specified.

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Points:	17	14	18	20	16	15	100
Score:							

12 1. Find the derivatives of the following functions. You do not need to simplify your answer.

(a) $f(x) = [\sin^{-1}(x) - x^3]^2$

(b) $f(x) = \sin^2 x + \cos^2 x$

(c) $f(x) = 2^{(3x^2 - 5x + \pi)}$

5 2. If $f(x) = \sec x$, find $f''(\pi/4)$.

- 8 3. Find $\frac{dy}{dx}$ by implicit differentiation. $(xy)^2 + 3x = y^2$

- 6 4. The Mean Value Theorem guarantees the existence of a special number c in the interval $(0, 4)$ for the function $f(x) = \sqrt{x}$. Find the number c .

5. If a ball is thrown vertically upward with a certain velocity, its height after t seconds is

$$s(t) = 9t - 2t^2.$$

Answer the following questions with correct units.

- 2 (a) What is the **velocity** of the ball after 2 sec?
- 4 (b) What is the **maximum height** reached by the ball?
- 4 (c) What is the **velocity** of the ball when it is 9 *ft* above the ground on its way down?
- 8 6. Use a linear approximation to approximate the value of $e^{0.2}$.

- 10 7. Determine the absolute maximum and minimum of f on the given interval.

$$f(x) = -x^2 + 3x - 2, \quad [1, 3]$$

- 10 8. Two cars start moving from the same point. One travels south at 60 mph and the other travels west at 25 mph. At what rate is the distance between the cars increasing two hours later?

- 8 9. Consider the function $f(x) = x e^{3x}$. Answer the following using **calculus**. Show your work to support your answer. (Answer produced from graphing calculator receives no credit.)

(a) Find the intervals on which f is increasing or decreasing. Answer in the space provided

f is increasing on

f is decreasing on

(b) Find the x -values where f attains its local maximum and minimum values.

f has local maximum at $x = \dots\dots$

f has local minimum at $x = \dots\dots$

- 8 10. Consider the function $f(x) = x + x^2 - x^3$. Answer the following using **calculus**. (Answer produced from graphing calculator receives no credit.)

(a) Find the intervals on which f is concave up or concave down.

f is concave up on

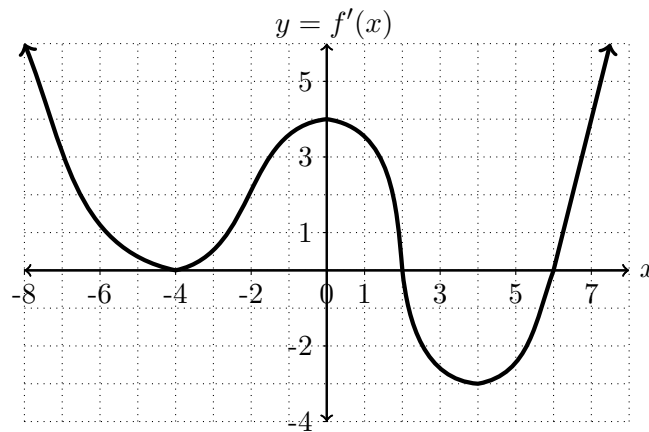
f is concave down on

(b) Find the x - coordinate(s) of inflection point(s) of f .

f has inflection point(s) at $x = \dots\dots\dots$

- 6 11. Find an equation of the tangent line to the curve $y = e^{\cos x}$ at $x = \frac{\pi}{2}$.

12. Use the graph of $y = f'(x)$ given below to **choose the correct answer** for each of the following questions about the function f . (No partial credit.)



- 3 (a) On what interval(s) is the graph of f decreasing?
 (a) $(-8, 0)$ (b) $(-8, 4) \cup (0, 4)$ (c) $(-4, 2)$ (d) $(2, 6)$
- 3 (b) Find the x -value(s) at which f has a local maximum.
 (a) -4 (b) 0 (c) 2 (d) 4 (e) 6
- 3 (c) On which interval(s) is the graph of f concave up?
 (a) $(-8, -2) \cup (1, \infty)$ (b) $(-4, 0) \cup (4, \infty)$ (c) $(-8, -4) \cup (0, 4)$ (d) $(-2, 3)$