Math 141, Exam 2
Practice Exam

Name: ____

Student ID: ____

Version: **A**

Instructions:

- Do NOT open exam booklet until instructed.
- Write your Name and Student ID Number on the lines above.
- Write your Name and Student ID Number on the answer sheet.
- Fill in version (A or B) on your answer sheet.
- No calculators, personal devices (phones, computers, tablets, etc.), or reference materials may be used during the exam.
- Indicate your answer to each question on the answer sheet by fully filling in the appropriate bubble.
- You may use any blank space on this exam booklet for your scratch work or ask for a blank sheet for scratch work. DO NOT USE YOUR OWN SCRATCH PAPER!
- The exam booklet and answer sheet will be collected at the end of the exam. Only the answer sheet will be graded.

1. If $f(x)$ has a relative minimum or relative maximum at $x = 3$, then $f'(3)$ must equal 0.

(a) The above statement is true.

(b) The above statement is false.

2. The first derivative of $f(x)$ is $f'(x) = (x + 3)(x - 6)$. Which of the following statements is true?

(a) $f(x)$ has a relative minimum at $x = -3$ and a relative maximum at $x = 6$.

(b) $f(x)$ has a relative maximum at $x = -3$ and a relative minimum at $x = 6$.

(c) $f(x)$ has relative minima at $x = -3$ and at $x = 6$.

(d) $f(x)$ has relative minima at $x = -3$ and at $x = 6$.

(e) the above statements are all false.

3. Find all inflection points of $f(x) = \frac{3}{5}x^5 - x^4 + 2x - 1$.

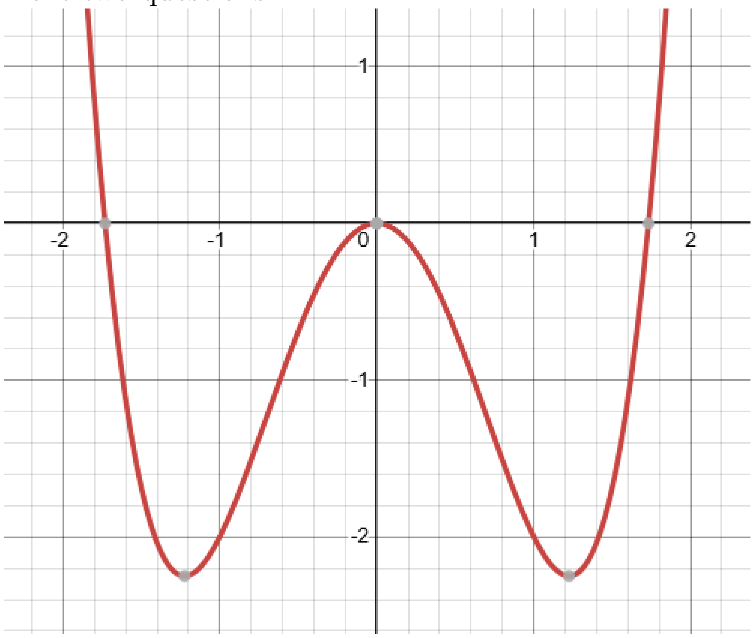
(a) $(0, f(0))$ and $(1, f(1))$.

(b) $(0, f(0))$ only.

(c) $(1, f(1))$ only.

(d) $f(x)$ has no inflection points.

Let $f(x)$ be a function whose **derivative** $f'(x)$ is graphed below. Use the graph to answer the next two questions.



4. Which of the following statements is true about $f(x)$ at $x = 0$?

(a) $f(x)$ has a relative maximum at $x = 0$, since the function is increasing to the left of $x = 0$ and decreasing to the right.

(b) $f(x)$ has a relative minimum at $x = 0$, since the function is decreasing to the left of $x = 0$ and increasing to the right.

(c) $f(x)$ has neither a relative minimum nor relative maximum at $x = 0$ since the function is decreasing to the left and right of $x = 0$.

(d) $f(x)$ has neither a relative minimum nor relative maximum at $x = 0$ since the function is increasing to the left and right of $x = 0$.

5. Which of the following statements is true about $f(x)$ at $x = 0$?

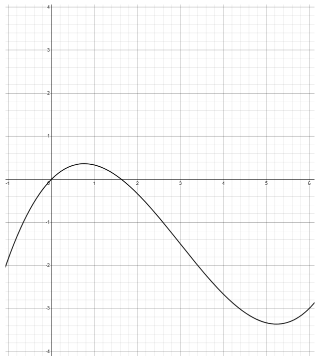
(a) $f(x)$ has an inflection point at $x = 0$, since the function is concave up to the left of $x = 0$ and concave down to the right of $x = 0$.

(b) $f(x)$ has an inflection point at $x = 0$, since the function is concave down to the left of $x = 0$ and concave up to the right of $x = 0$.

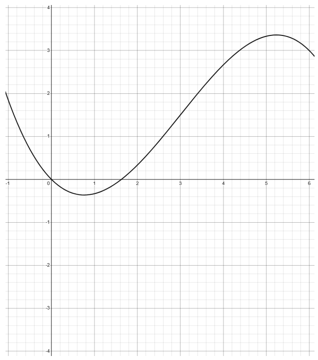
(c) $f(x)$ does not have an inflection point at $x = 0$, since the function is concave up both to the left and right of $x = 0$.

(d) $f(x)$ does not have an inflection point at $x = 0$, since the function is concave down both to the left and right of $x = 0$.

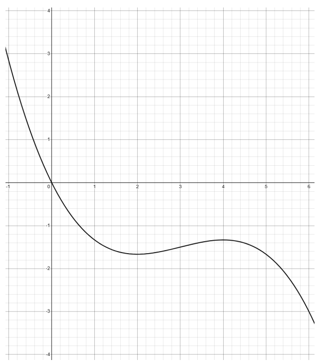
6. Which of the following functions satisfy $f'(5) > 0$ on , $f''(5) > 0$?



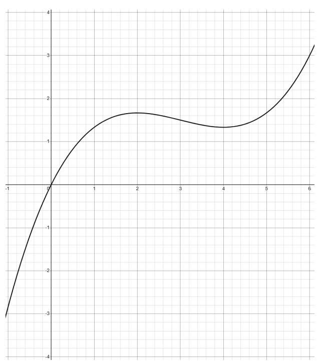
(a)



(b)



(c)



(d)

7. Consider the function $f(x) = -1/2x^2 + 6x - 1$. The absolute minimum value of this function on the interval $[0, 10]$ is

(a) $f(0)$

(b) $f(6)$

(c) $f(10)$

(d) none of these.

8. Let $f(x)$ be a continuous function which is everywhere differentiable. Suppose f has a unique critical point at $x = 5$ and $f''(5) < 0$. What can you conclude about $f(5)$?

(a) $f(5)$ is the absolute maximum of $f(x)$.

(b) $f(5)$ is the absolute minimum of $f(x)$.

(c) $f(5)$ is a relative maximum of $f(x)$, but not necessarily an absolute maximum.

(d) $f(5)$ is a relative minimum of $f(x)$, but not necessarily an absolute minimum.

(e) There is not enough information to conclude whether or not $f(5)$ is a relative extremum and/or an absolute extremum.

9. Find the linearization of $f(x) = \sqrt[3]{x}$ at $x = 8$.

(a) $y = -2 + \frac{1}{12}(x - 8)$

(b) $y = 2 + \frac{1}{12}(x - 8)$

(c) $y = 2 - \frac{1}{12}(x + 8)$

(d) $y = -2 - \frac{1}{12}(x - 8)$

10. Use the linearization of $f(x) = \sqrt[3]{x}$ at $x = 8$ to approximate $\sqrt[3]{7}$.

(a) $-2 - \frac{1}{12}$

(b) $2 - \frac{1}{12}$

(c) $2 + \frac{1}{12}$

(d) $-2 + \frac{1}{12}$

11. Which of the following best describes the purpose of linearization?

(a) Linearization is used to find the exact value of a function at a point.

(b) Linearization is used to approximate the value of a function near a point using the tangent line.

(c) Linearization is used to find the maximum or minimum values of a function.

(d) Linearization is used to approximate the value of a function near a point using the second derivative.

12. Maximize $B = 3xy^2$, where x and y are positive numbers such that $x + y^2 = 8$.

(a) 48

(b) 42

(c) 52

(d) 36

13. A rectangular box with a square base with and open top will have a volume of 4 in^3. If x represents the side lengths of the base and y represents the height of the box. Find an equations for the surface area S of the box and the volume V of the box.

(a) $S = 4xy + 2x^2$, $V = x^2y$

(b) $S = 4xy + x^2$, $V = x^2y$

(c) $S = 4xy + x^2$, $V = x^2y^2$

(d) $S = 4xy + x^2$, $V = xy^2$

14. A rectangular box with a square base will have a volume of 4 in^3. What is the minimum surface area of the box?

(a) 12

(b) 16

(c) 20

(d) 8

15. Let $x^2y^2 = 16$, find $\frac{dy}{dx}$.

(a) $\frac{2y}{x}$

(b) $\frac{-y}{x}$

(c) $\frac{-x}{y}$

(d) 0

16. Find the equation of the tangent line to the curve $x^2y^2 = 16$ at the point $(1, 4)$

(a) $y = 4 - 4(x - 1)$

(b) $y = -4 - \frac{1}{4}(x - 1)$

(c) $y = 4 - \frac{1}{4}(x - 1)$

(d) $y = 4$

17. Differentiate $p^4 + p - 2t = 15$ to find $\frac{dp}{dt}$

(a) $\frac{2}{4p^3+p}$

(b) $\frac{-2}{4p^3+1}$

(c) $\frac{2}{4p^3+1}$

(d) $-4p^3 + 2$

18. Given $y = 2x^2 + 3$, find $\frac{dy}{dt}$ when $x = -1$ and $\frac{dx}{dt} = 5$.

(a) -20

(b) -23

(c) 23

(d) -10

19. An ice cube is melting such that the length of the edges of the cube are decreasing by $0.5\ cm/min$. How fast is the volume of the cube changing when the edges are $2\ cm$.

(a) $6\ cm^3/min$

(b) $-6\ cm^3/min$

(c) $3\ cm^3/min$

(d) $-3\ cm^3/min$

20. The answer to the previous question is

(a) positive, because the volume is increasing as the edge length decreases.

(b) positive, because the volume is decreasing as the edge length decreases.

(c) negative, because the volume is increasing as the edge length decreases.

(d) negative, because the volume is decreasing as the edge length decreases.