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001

Math 112 Exam 2

Nov 10, 11, & 13
Late day Nov 14, 2017

Name: _____

Section: _____

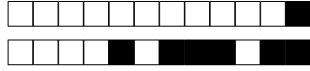
Instructor: _____

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Instructions

1. Do not write on the barcode area at the top of each page, or near the four circles on each page.
2. Fill in the correct boxes for your BYU ID and for the correct answer on the multiple choice completely.
3. For questions which require a written answer, show all your work in the space provided and justify your answer.
4. Simplify your answers.
5. No books or notes are allowed.
6. There is no time limit on this exam.



Part I: Multiple Choice Questions: (4 points each) Choose the best answer for each multiple choice question. Fill in the box completely for the the correct answer.

1 Find $f'(x)$ for $f(x) = \frac{\cos x}{1 - \sin x}$.

$\frac{\sin x - \cos^2 x}{1 - \sin x}$

$\frac{-1}{1 - \sin x}$

$\frac{2}{(1 - \sin x)^2}$

$\frac{1 + 2 \sin x \cos x}{(1 - \sin x)^2}$

$\frac{1}{1 - \sin x}$

$\frac{1 - \sin x}{\cos^2 x}$

$\frac{\sin^2 x - \cos^2 x - \sin x}{(1 - \sin x)^2}$

$\frac{\cos^2 x - \sin x}{1 - \sin x}$

2 Find the absolute minimum value of $f(x) = (x^2 - 4)^3$ on the interval $[-2, 3]$.

54

0

-27

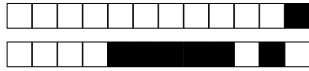
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-2

-64

-125

25



- 3 Below is a table of values for f , f' , g , and g' . Let $h(x) = f(g(x))$. What is $h'(2)$?

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	-2	-4	1	-1
2	-1	3	3	4
3	-3	2	5	1

- 2
- 1
- 20
- 15
- 3
- 12
- 9
- 4

- 4 Let $y = \tan^{-1}(x^2 - x)$. What is $y'(2)$?

- $\frac{1}{10}$
- $\frac{3}{16}$
- 1
- $\frac{1}{5}$
- $\frac{1}{16}$
- $\frac{3}{10}$
- $\frac{3}{13}$
- $\frac{3}{5}$



5 Find $f'(x)$ for $f(x) = \ln(e^{-x} + xe^{-x})$.

$\frac{-2}{1+x}$

$\frac{2-x}{1+x}$

$\frac{-x}{1+x}$

$(-xe^{-x}) \ln(e^{-x} + xe^{-x})$

$-xe^{-x}$

-1

$\frac{1}{e^{-x} + xe^{-x}}$

0

6 Consider the function $f(x) = 3x^{4/3} - 9x^{1/3}$. Find all the critical numbers of f .

$x = 0, \frac{3}{4}$

$x = \frac{3}{4}$

$x = \frac{4}{3}$

f has no critical numbers

$x = \frac{3}{4}, \frac{4}{3}$

$x = 0$

$x = 0, \frac{4}{3}$

$x = 0, \frac{3}{4}, \frac{4}{3}$



7 Find the limit: $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3}$.

- $-\frac{1}{6}$
- $-\frac{1}{12}$
- ∞
- 0
- $-\infty$
- $-\frac{1}{3}$
- $-\frac{1}{2}$
- 1

8 Let f be a function that has first derivative $f'(x) = \frac{-x^2 + x + 2}{(x^2 + 2)^2}$ and second derivative $f''(x) = \frac{2x^3 - 3x^2 - 12x + 2}{(x^2 + 2)^3}$. At which of the following x -values does f have a local maximum?

- $x = 2$
- $x = 1$
- $x = 0$
- $x = -3$
- $x = 3$
- $x = 4$
- $x = -1$
- $x = -2$

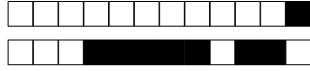


9 Let $f(x) = \cos x$. Determine the 34th derivative of $f(x)$.

- $\cos x$
- $\sin x$
- $-\sin x$
- $-34 \sin^{33} x$
- $-34 \cos^{33} x$
- $34 \cos^{33} x$
- $34 \sin^{33} x$
- $-\cos x$

10 A stone is dropped into a lake creating a circular ripple that travels outward at a speed of 10 cm per second. Find the rate at which the area of the circle is increasing after 6 seconds.

- $12 \pi \text{ cm}^2/\text{sec}$
- $3600 \pi \text{ cm}^2/\text{sec}$
- $360 \pi \text{ cm}^2/\text{sec}$
- $120 \pi \text{ cm}^2/\text{sec}$
- $36 \pi \text{ cm}^2/\text{sec}$
- $20 \pi \text{ cm}^2/\text{sec}$
- $1200 \pi \text{ cm}^2/\text{sec}$
- $100 \pi \text{ cm}^2/\text{sec}$



11 Find $\frac{dy}{dx}$ for $x^3 + y^3 = 1$.

$-\frac{3x^2}{y^2}$

$-\frac{3y^2}{x^2}$

$\frac{y^2}{x^2}$

$-\frac{x^2}{y^2}$

$\frac{x^2}{y^2}$

$\frac{3y^2}{x^2}$

$-\frac{y^2}{x^2}$

$\frac{3x^2}{y^2}$

12 If f is differentiable, find $\frac{d}{dx} (\sqrt{f(x)})$.

$\frac{1}{2\sqrt{f(x)}}$

$\frac{\sqrt{f'(x)}}{2\sqrt{f(x)}}$

$\frac{x}{2\sqrt{f'(x)}}$

$\frac{1}{\sqrt{f(x)}}$

$\frac{f'(x)}{2\sqrt{f(x)}}$

$\frac{f'(x)}{\sqrt{f(x)}}$

$\frac{\sqrt{f(x)}}{2\sqrt{f'(x)}}$

$\frac{x}{2\sqrt{f(x)}}$



13 The cost of producing x units of stuffed cougar toys is $C(x) = 0.002x^2 + 5x + 3000$. Find the marginal cost at the production level of 1000 units in dollars per unit.

- 9
- 1,000
- 5
- 5,002
- 2
- 10,000
- 7
- 3,000

14 Given the function $f(x) = \frac{1}{x}$, find the value of c that satisfies the conclusion of the Mean Value Theorem on the interval $[1, 2]$.

- $\frac{4}{3}$
- $\frac{5}{4}$
- $\frac{3}{2}$
- $\frac{\sqrt{5}}{2}$
- $\frac{\sqrt{6}}{2}$
- $\sqrt{3}$
- $\frac{5}{3}$
- $\sqrt{2}$



Part II: Free Response Questions: *Neatly write solutions for these problems directly on the exam paper. (Work on scratch paper will not be graded.)*

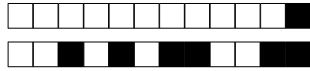
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0 1 2 3 4 5 6 7 8 *Administrative Use Only*

Find $\frac{dy}{dx}$ for each of the following.

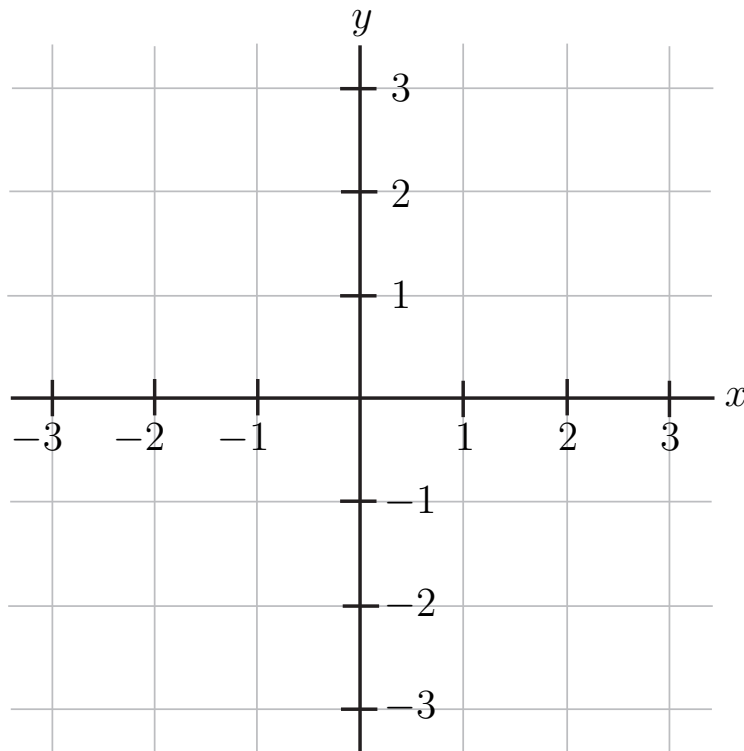
(a) $e^x \sin x = x + xy$

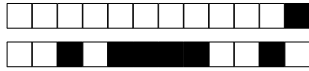
(b) $y = (\cos x)^x$



Sketch the graph of a function f that satisfies the following: (Make sure your sketch clearly shows where the graph is increasing, decreasing, concave up, and concave down)

- (a) The domain of f is all real numbers and $f(0) = 0$;
- (b) $f'(x) < 0$ on $(0, 1)$;
- (c) $f'(x) > 0$ on $(1, \infty)$;
- (d) $f''(x) > 0$ on $(0, 2)$;
- (e) $f''(x) < 0$ on $(2, \infty)$;
- (f) $\lim_{x \rightarrow \infty} f(x) = -1$;
- (g) f is even;
- (h) f is not differentiable at $x = 0$.



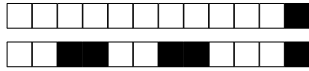


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Use implicit differentiation to show that

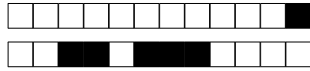
$$\frac{d}{dx} (\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}.$$



18

0 1 2 3 4 5 6 7 8 *Administrative Use Only*

Two ships are headed to the same port. At noon, ship A is 120 miles south of the port and ship B is 80 miles east of the port. Ship A is sailing north at 20 mi/h and ship B is sailing west at 10 mi/h. Determine how fast the distance between the ships is changing at 2:00 pm.



+1/13/48+

19

0 1 2 3 4 5 6 7 *Administrative Use Only*

Show that $2x + \cos x = 0$ has exactly one solution on $(-\infty, \infty)$. Name any theorems you use.

