Fall 2014

MTH 132 FINAL EXAM

December 8, 2014

Name: ______________________________ **PID:** ____________________

Section: ____________ **Instructor**: ______________________________

DO NOT WRITE BELOW THIS LINE. Go to the next page.

Page	Problem	Score	Max Score
1	1		5
	2		5
	3		5
	4		5
	5		5
2	6		5
	7		5
	8		5
	9		5
	10		5
3	11a		8
	11b		4
	12		10
4	13a		6
	13b		6
	13c		6
	13d		4
5	14a		8
	14b		8
	14c		8
6	15		8
	16		8
7	17		8
	18		12
8	19		12
9	20		12
10	21a		2
	21b		2
	21c		2
	21d		2
	21e		2
	21f		4
	21g		4
	21h		4
Total Score			200

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Section: ______________ **Instructor**: ______________________

READ THE FOLLOWING INSTRUCTIONS.

- **Do not open your exam until told to do so.**
- No calculators, cell phones or any other electronic devices can be used on this exam.
- Clear your desk of everything excepts pens, pencils and erasers.
- If you need scratch paper, use the back of the previous page.
- Without fully opening the exam, check that you have pages 1 through 10.
- Fill in your name, etc. on these first two pages.
- **Show all your work.** Write your answers clearly! Include enough steps for the grader to be able to follow your work. Don't skip limits or equal signs, etc. Include words to clarify your reasoning.
- Do first all of the problems you know how to do immediately. Do not spend too much time on any particular problem. Return to difficult problems later.
- If you have any questions please raise your hand and a proctor will come to you.
- There is no talking allowed during the exam.
- You will be given exactly 120 minutes for this exam.

I have read and understand the above instructions: ______________________

SIGNATURE

SCORE:

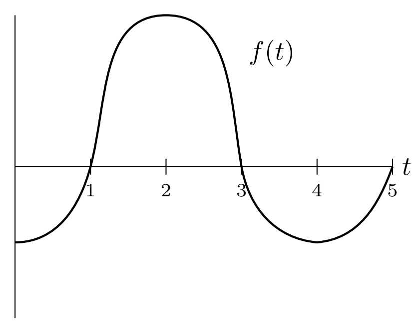
Multiple Choice. Circle the best answer. No work needed. No partial credit available.

1. Evaluate $\lim_{x \to -1} \dfrac{x^2+2x+1}{x+1}$
   (a) 1
   (b) -1
   (c) 2
   (d) 0
   (e) None of the above.

2. Evaluate $\lim_{x \to -1} \dfrac{x+1}{|x+1|}$
   (a) 1
   (b) -1
   (c) 2
   (d) 0
   (e) None of the above.

3. Find c so that $f(x) = \begin{cases} \frac{\sin(3x+x^2)}{x} & \text{if } x \neq 0 \\ c & \text{if } x = 0 \end{cases}$ is continuous.
   (a) $c = 3$
   (b) $c = 2$
   (c) $c = 1$
   (d) $c = -1$
   (e) None of the above.

4. The graph of $f(t)$ is shown below. If $F(x) = \int_0^x f(t)\,dt$, for what value of x is $F(x)$ an absolute maximum on $[0,5]$?
   (a) $x = 0$
   (b) $x = 1$
   (c) $x = 2$
   (d) $x = 3$
   (e) None of the above.



5. Evaluate $\int x(2x^2+1)^3\,dx$
   (a) $\frac{1}{16}(2x^2+1)^4 + C$
   (b) $\frac{1}{12}(2x^2+1)^4 + C$
   (c) $\frac{1}{8}(2x^2+1)^4 + C$
   (d) $\frac{1}{4}(2x^2+1)^4 + C$
   (e) None of the above.

Fill in the Blanks. No work needed. Only possible scores given are 0, 3, and 5.

6. If $f(x) = x^2 \sin x$ then $f'(x) =$ ________________________________

7. The vertical asymptote(s) of $f(x) = \dfrac{1-x}{x+2}$ are ________________________. The horizontal asymptote(s) of $f(x)$ are ____________________________.

8. $\dfrac{d}{dt}\left(\dfrac{(t+\tan t)^2}{\sqrt{t}}\right) =$ ____

9. A function which satisfies $y'(x) = 4x$ and $y(1) = 5$ is given by $y(x) =$ _________________

10. Let f and g be differentiable functions such that

$$\begin{array}{lll} f(0) = 2 & f'(0) = 3 & f'(2) = 4 \\ g(0) = 2 & g'(0) = -1 & g'(2) = 5 \end{array}$$

If $h(x) = g(f(x))$ then $h'(0) =$ _____________________

Extra Work Space.

Standard Response Questions. Show all work to receive credit. Please put your final answer in the **BOX**.

11. (8+4=12 points) Throughout this problem y is defined implicitly as a function of x.

(a) Find the slope of the tangent line to the curve $y^2 + 7x = x^2y + 9$ at the point $(1, 2)$.

Answer:

(b) Write the equation of the tangent line to the curve at the point $(1, 2)$.

Answer:

$y =$

12. (10 points) Use the *definition* of the derivative *as a limit* to calculate $f'(x)$ for $f(x) = \dfrac{2}{x-3}$. (**There will be no credit for other methods.**)

Answer:

$f'(x) =$

13. (6+6+6+4=22 points) Let $f(x) = x + 2\cos(x)$ on the interval $[0, 2\pi]$.

(a) Find the intervals within $[0, 2\pi]$ on which f is increasing and the intervals on which f is decreasing.

Answer:

f is increasing on:
f is decreasing on:

(b) Find the intervals within $[0, 2\pi]$ on which f is concave up and the intervals on which f is concave down.

Answer:

f is concave up on:
f is concave down on:

(c) Indicate the y-intercept, any local maxes/mins, and inflection points.

Answer:

f has $y-$intercept at: $(x, y) =$
f has local max(s) at: $x =$
f has local min(s) at: $x =$
f has inflection point(s) at: $x =$

(d) Locate the absolute maximum of f on $[0, 2\pi]$.

Answer:

f has an absolute max at: $x =$

14. (8+8+8=24 points) Evaluate the following integrals:

(a) $\displaystyle\int \frac{x^3}{\sqrt{1+2x^4}}\,dx$

Answer:

(b) $\displaystyle\int \frac{\sec\left(\frac{x}{2}\right)\tan\left(\frac{x}{2}\right)}{\sqrt{\sec\left(\frac{x}{2}\right)}}\,dx$

Answer:

(c) $\displaystyle\int_8^{11} x\sqrt{x-7}\,dx$

Answer:

15. (8 points) Use the Fundamental Theorem of Calculus to find the derivative of

$$F(x) = \int_{\pi}^{\sqrt{x}} \frac{2\sin(t^2) - 1}{\sqrt{t^4 + 1}}\ dt$$

Answer:

$F'(x) =$

16. (8 points) Estimate $\displaystyle\int_1^4 \frac{2x-1}{\sqrt{x}}\ dx$ using areas of 3 rectangles of equal width, with heights of the rectangles determined by the height of the curve at left endpoints (Do not simplify).

Answer:

17. (8 points) Use a linear approximation to estimate $\sqrt[3]{26}$.

Hint: Is 26 close to a number whose cube root is well-known?

Answer:

$\sqrt[3]{26} \approx$

18. (12 points) Find the area of the region enclosed by the graphs of the equations $y = 2x^2 + x - 2$ and $y = x^2 - x + 1$.

Answer:

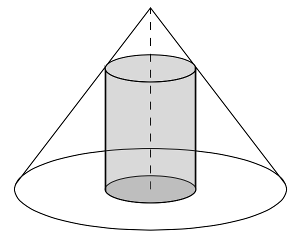
Area =

19. (12 points) The top of a 13 foot ladder, leaning against a vertical wall, is slipping down the wall at the rate of 2 feet per second. How fast is the bottom of the ladder sliding along the ground away from the wall when the bottom of the ladder is 5 feet away from the base of the wall?

Answer:

ft/s

20. (12 points) A cylinder is inscribed in a right circular cone of height 4 inches and radius (at the base) equal to 3 inches. What are the dimensions of such a cylinder that has maximum volume?



You MUST verify that you have found the maximum.

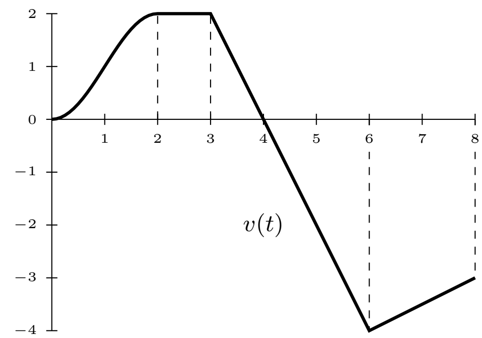
Hint: Recall the formula for volume of a cylinder: $V = \pi r^2 h$

Answer:

height =
radius =

21. (2+2+2+2+2+4+4+4=22 points)

The graph to the right shows the velocity $v(t)$ in meters per second of a particle moving on a horizontal coordinate line, for t in seconds within the closed interval $[0, 8]$.



(a) When is the particle moving forward?

Answer:

$t \in$ s

(b) When is the particle's speed decreasing?

Answer:

$t \in$ s

(c) When is the particle's acceleration positive?

Answer:

$t \in$ s

(d) When is the particle's acceleration the greatest?

Answer:

$t =$ s

(e) When does the particle move at its greatest speed?

Answer:

$t =$ s

(f) What is the change in the particle's position from $t = 2$ to $t = 6$?

Answer:

Change in position = m

(g) What is the total distance the particle travels from $t = 2$ to $t = 6$?

Answer:

Distance traveled = m

(h) If the particle is at the origin at $t = 2$ use linear approximation to estimate its position at $t = 3/2$

Answer:

$s(3/2) \approx$ m