Name:_____

Student ID:_____

Section:_____

Instructor:_____

Math 2413 (Calculus I)
Practice Exam 2

Instructions:

- Each question is worth 5 points.
- Work on scratch paper will not be graded.
- No partial credit will be given for the multiple choice part and the short answer part.
- For questions 19 to 20, show all your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer.
- **Please write neatly. If I cannot read your handwriting, you will not receive credit.**
- Simplify your answers as much as possible. Expressions such as $\ln(1)$, e^0, $\sin(\pi/2)$, etc. must be simplified for full credit.

Multiple Choice. Circle the correct answer for each question. Circle one choice only.

1. (Section 3.6) Find the derivative of the function $y = \sin(\sin(\sin(x)))$

   a) $\cos(\cos(\cos x))$

   b) $\cos(\cos(\cos x))\cos(\cos x)$

   c) $\cos(\cos(\cos x))\cos(\cos x)\cos x$

   d) $\cos(\sin(\sin x))\sin(\sin x)$

   e) $\cos(\sin(\sin x))\sin(\sin x)\cos x$

   f) $\cos(\sin(\sin x))\cos(\sin x)\cos x$

2. (Section 3.6) Let $y = (f(u) + 4x)^2$ and $u = x^3 - 2x$. If $f(4) = 5$ and $\dfrac{dy}{dx} = 13$ when $x = 2$, find $f'(4)$.

   a) $-\dfrac{7}{2}$

   b) $\dfrac{7}{2}$

   c) $-\dfrac{7}{20}$

   d) $\dfrac{7}{20}$

   e) $-\dfrac{7}{10}$

   f) $\dfrac{7}{10}$

3. (Section 3.6) Let $u(x) = f(g(x))$ where the graph of f and g are shown in figure 1. Find $u'(1)$.

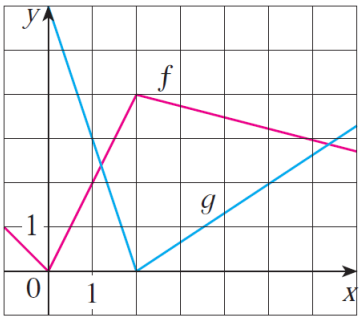

Figure 1: Figure for Question 3

   a) -6

   b) 6

   c) $-\dfrac{2}{3}$

   d) $\dfrac{2}{3}$

   e) $-\dfrac{3}{4}$

   f) $\dfrac{3}{4}$

4. (Section 3.7) Let $f(x) = x^5 + 3x^3 - 4x - 5$. Find the slope of the tangent line to the graph of its inverse function f^{-1} at the point $P(-5, 1)$ on the graph of f^{-1}.

   a) $-\dfrac{1}{10}$

   b) $\dfrac{1}{10}$

   c) $-\dfrac{1}{3346}$

   d) $\dfrac{1}{3346}$

   e) $-\dfrac{1}{9}$

   f) $\dfrac{1}{9}$

5. (Section 3.7) Find the derivative of the function $y = \sin^{-1}\left(\sqrt{\sin x}\right)$

a) $\dfrac{1}{2\sqrt{1-\sin x}\sqrt{\sin x}}$

b) $\dfrac{-\cos(x)}{2\sqrt{1-\sin x}\sqrt{\sin x}}$

c) $\dfrac{\cos(x)}{2\sqrt{1-\sin x}\sqrt{\sin x}}$

d) $\dfrac{\cos(x)}{2\sqrt{1-\sin^2 x}\sqrt{\sin x}}$

e) $\dfrac{-\cos(x)}{2\sqrt{1-\sin^2 x}\sqrt{\sin x}}$

f) $\dfrac{\sin(x)}{2\sqrt{1-\sin^2 x}\sqrt{\sin x}}$

6. (Section 3.7) A television camera at ground level is 2000 feet away from the launching pad of a space rocket that is set to take off vertically. The angle of elevation of the camera can be found by $\theta = \tan^{-1}\left(\dfrac{x}{2000}\right)$ where x is the height of the rocket (in feet)Find the rate of change (in radians per foot) of the angle of elevation after launch when the camera and the rocket are 3000 feet apart.

a) $\dfrac{1}{3500}$

b) $\dfrac{1}{4500}$

c) $\dfrac{1}{5000}$

d) $\dfrac{1}{9500}$

e) $\dfrac{1}{2501}$

f) $\dfrac{1}{9501}$

7. (Section 3.8) Find the equation of the tangent line to the graph of the equation $x^2y^2+5xy = 36$ at the point $(4, 1)$.

a) $y = 4x - 15$

b) $y = -4x + 17$

c) $y = \dfrac{1}{4}x$

d) $y = -\dfrac{1}{4}x + 2$

e) $y = 5x - 19$

f) $y = \dfrac{1}{5}x + \dfrac{1}{5}$

8. (Section 3.8) Find the x-value of the point in the first quadrant at which the tangent line to the curve $x^3 + y^3 = 6xy$ is horizontal.

a) $\sqrt[3]{2}$

b) $\sqrt[3]{4}$

c) 2

d) $\sqrt[3]{16}$

e) $\sqrt[3]{32}$

f) 4

9. (Section 3.9) Let $f(x) = 4^{\sin(4x)}$. Find $f'(x)$

a) $4^{\sin(4x)} \ln(4)$ b) $4^{\cos(4x)} \ln(4)$ c) $4^{\sin(4x)} \ln(4) \cos(4x)$

d) $4^{\cos(4x)} \ln(4)$ e) $4^{\sin(4x)+1} \ln(4) \cos(4x)$ f) $4^{\sin(4x)} \ln(16) \cos(4x)$

10. (Section 3.9) For which x-value(s) does $f(x) = \dfrac{(\ln(x))^8}{x^2}$ have horizontal tangent lines?

a) $0, e^2$ b) $0, e^4$ c) $0, e^8$

d) $1, e^2$ e) $1, e^4$ f) $1, e^8$

11. (Section 3.9) Find the x-value of the point on the curve $y = 1 + 2e^x - 3x$ at which the tangent line is parallel to the line $y = 3x - 5$.

a) $x = e$ b) $x = e^2$ c) $x = e^3$

d) $x = \ln(2)$ e) $x = \ln(3)$ f) $x = 0$

12. (Section 4.1) The base of a triangle is shrinking at a rate of 1 cm/min and the height of the triangle is increasing at a rate of 3 cm/min. Find the rate (in cm^2/min) at which the area of the triangle changes when the height is 34 cm and the base is 18 cm.

a) $5\text{cm}^2/\text{min}$ b) $10\text{cm}^2/\text{min}$ c) $15\text{cm}^2/\text{min}$

d) $20\text{cm}^2/\text{min}$ e) $25\text{cm}^2/\text{min}$ f) $30\text{cm}^2/\text{min}$

13. (Section 4.1) A 16 ft ladder is leaning against a wall. If the top of the ladder slides down the wall at a rate of 2 ft/s, how fast (in ft/s) is the bottom moving along the ground when the bottom of the ladder is 8 ft from the wall?

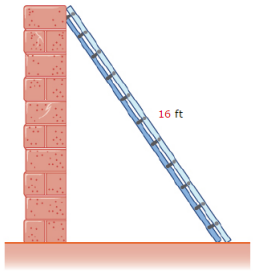

Figure 2: Figure for Question 13

a) $2\sqrt{2}$ b) $3\sqrt{2}$ c) $2\sqrt{3}$

d) $3\sqrt{3}$ e) $4\sqrt{2}$ f) $4\sqrt{3}$

14. (Section 4.1) Let x and y be functions of t and suppose that $y = \sqrt{2x+1}$. Find $\dfrac{dy}{dt}$ when $x = 4$ given that $\dfrac{dx}{dt} = 3$.

a) 0 b) $\dfrac{1}{2}$ c) 1

d) $\dfrac{3}{2}$ e) 2 f) $\dfrac{5}{2}$

15. (Section 4.2) Given $y = \sqrt{x}$, $x = 1$, $\Delta x = 1$. Find Δy and dy

a) $\Delta y = dy = 0.414$ b) $\Delta y = dy = 0.5$ c) $\Delta y = 0.414$, $dy = 0.5$

d) $\Delta y = 0.5$, $dy = 0.414$ e) $\Delta y = 1.414$, $dy = 1$ f) $\Delta y = 1$, $dy = 1.414$

16. (Section 4.2) Find the change in volume dV if the sides of a cube change from 11 to 11.1.

a) 12.1 b) 24.2 c) 36.3

d) 36.6 e) 36.63 f) None of the above

Short Answer: Write your final answer clearly for each question. No work will be graded. No partial credit.

17. (5 points) Let x and y be functions of t and suppose that $y = \sqrt{2x+1}$. Find $\dfrac{dy}{dt}$ when $x = 4$ given that $\dfrac{dx}{dt} = 3$.

Answer:

18. (5 points) Find $\dfrac{dy}{dx}$ for $y = (\ln x)^{\cos x}$.

Answer:

Essay: Show all work in the space provided. Full credit will be given only if all steps are shown justifying your answer. Please write neatly and carefully, if I cannot read your handwriting, you will receive NO credit. Scratch work will not be graded.

19. (5 points)(Section 3.8) Find $\dfrac{d^2y}{dx^2}$ at the point where $x = 0$ given that $xy + e^y = e$.

20. (5 points) (Section 4.1) A trough has ends shaped like isosceles triangles, with width 7 m and height 8 m, and the trough is 14 m long. Water is being pumped into the trough at a rate of 9 m^3/min. At what rate (in m/min) does the height of the water change when the water is 1 m deep?

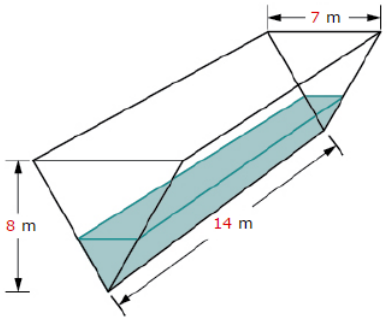

Figure 3: Figure for Question 20

END OF EXAM