	Name:Student ID:Section:	
	Instructor: Paul Gustafson	
Math 131 (Principles of Final Exam B	GREEN	
Instructions:  • Simplify your answers.		
• Calculators are allowed		

- $\bullet\,$  Simplify your answers.
- Calculators are allowed.
- Should you have need for more space than is allocated to answer a question, use the back of the exam.
- Honor Code:

An Aggie	does no	t lie, chea	at, or stea	al or toler	ate those	who do
Signature						

 ${\bf Multiple\ Choice\ (5\ points\ each)}\ {\it Mark\ the\ correct\ answer\ on\ the\ bubble\ sheet}.$ 

For questions 1-4, use the following graph of f(x):

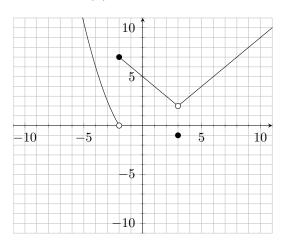


Figure 1: f(x)

1. According to the graph of f(x), the  $\lim_{x\to 3} f(x)$  equals which of the following.

a) -3

b) 8

c) -1

d) 2

e) The limit does not exist.

2. According to the graph of f(x), the  $\lim_{x\to -2^-} f(x)$  equals which of the following.

a) 7

b) 0

c) -2

d) -5

e) The limit does not exist.

3. According to the graph of f(x), the  $\lim_{x\to 5} f(x)$  equals which of the following.

a) 8

b) 4

c) -1

d) 0

e) The limit does not exist.

4. According to the graph of f(x), the function f(x) is not continuous at x=3 because

- a) there is a horizontal asymptote at x = 3.
- b) there is a vertical asymptote at x = 3.
- c) f(x) is not defined at x = 3.

- d)  $\lim_{x\to 3} f(x)$  does not exist.
- e) there is a removable discontinuity at x = 3

5. The graph of g(x) is given below.

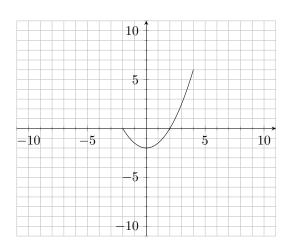


Figure 2: g(x)

According to the graph above, the domain and range of g(x) are

a) Domain: [-4, 4], Range: [-6, 2]

b) Domain: [-2, -6], Range: [-2, 4]

c) Domain: [-4, 4], Range: [-4, 2]

d) Domain: [-6, 2], Range: [-2, 4]

- e) Domain: [-2, 4], Range: [-2, 6]
- 6. Find the domain of  $f(x) = \frac{1}{x^2 16}$ .
  - a)  $(-2,2) \cup (2,\infty)$

b)  $(-\infty, -4) \cup (-4, 4) \cup (4, \infty)$ 

c)  $(-\infty, -4) \cup (0, \infty)$ 

d)  $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$ 

- e) [-2, 2)
- 7. Let  $f(x) = \sqrt{4 x^2}$  and  $g(x) = \ln(x)$ . What is the domain of f(x)g(x)?
  - a) (0,2]

b) [-1,2)

c)  $[-2,\infty)$ 

d)  $(0,\infty)$ 

e) [-2, 2]

- 8. Evaluate  $\lim_{x \to 3} \frac{\sqrt{25 x^2} 4}{3 x}$ .
  - a) 1

 $b) \quad \frac{\sqrt{23} - 4}{2}$ 

c) -2

d)  $\frac{3}{4}$ 

- e) 9
- 9. Given a function f(x), then the graph of 2f(3-x) will be
  - a) the graph of f(x) shrunk horizontally by a factor of 2, shifted 4 units up, then reflected across the x-axis.
- b) the graph of f(x) stretched vertically by a factor 3, shifted 2 units up, then reflected across the y-axis.
- c) the graph of f(x) stretched vertically by a factor of 2, shifted 3 units to the right, then reflected across the y-axis.
- d) the graph of f(x) stretched vertically by a factor of 2, shifted 3 units to the left, then reflected across the y-axis.
- e) the graph of f(x) shrunk horizontally by a factor of 3, shifted 4 units to the right, then reflected across the x-axis.
- 10. A bacteria population doubles every 47 minutes. If the initial population is 1000 bacteria, how many bacteria will there be after 5 hours?
  - a)  $4.2 \times 10^4$

b)  $3.2 \times 10^3$ 

c)  $4.3 \times 10^3$ 

d)  $1.2 \times 10^3$ 

- e)  $8.3 \times 10^3$
- 11. Find the derivative of the function  $f(x) = \frac{3}{x^3} 4x^2 + 3$ .
  - a)  $-\frac{15}{x^2} 8x$

b)  $-\frac{15}{x^2} + 3$ 

 $c) \quad -\frac{9}{x^4} - 8x$ 

d)  $-\frac{9}{x^4} - 4$ 

e)  $-\frac{10}{x} - 3$ 

For the next two questions, use the following graph of f'(x):

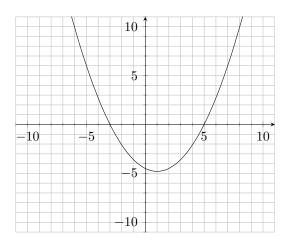


Figure 3: f'(x)

- 12. According to the graph of f'(x), the original function f(x) has a local maximum at
  - a) -5

b) -3

c) 0

d) 1

- e) 5
- 13. According to the graph of f'(x), the original function f(x) is concave upward in which interval(s)?
  - a)  $(-\infty, \infty)$

b)  $(-\infty, -3) \cup (1, 5)$ 

c)  $(1,\infty)$ 

- d)  $(-\infty, -3)$
- e) The original function f(x) is never concave up.
- 14. A vertical spring is released at time t = 0 seconds and begins to oscillate in a straight vertical line. The height of its endpoint above the ground in meters is given by the function

$$h(t) = 3 - 0.2\cos(2t)$$

To two decimal places, what is the velocity (in meters/second) of the spring's endpoint at time t=3?

a) -0.11

b) -0.06

c) 0.12

d) 2.12

e) 2.84

15. Find the linear approximation to  $\sqrt{x^2 + 8}$  at x = 1

a)  $3x + \sqrt{8}$ 

b)  $\frac{2}{3}x + 3$ 

c)  $\frac{1}{3}x + \frac{8}{3}$ 

 $d) \quad x + \sqrt{8}$ 

e)  $\frac{1}{3}x + 3$ 

16. We are given an unknown function f(x) such that f'(2) > 0 and f''(2) < 0. We can conclude that at x = 2, the function f(x) has

a) a local min.

b) a local max.

c) an inflection point.

d) an undefined derivative.

e) none of the above.

17. Calculate the equation of the tangent line to  $y = \frac{1}{x}$  at x = 2

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

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

c)  $y = -\frac{1}{4}x + \frac{1}{2}$ 

d)  $y = x + \frac{1}{2}$ 

e) 
$$y = -\frac{1}{4}x + 1$$

18. Find the absolute maximum and minimum values for the function  $f(x) = \ln(x^2 + 1)$  on the interval [-1,3]

- a) maximum value = 2.30, minimum value = 1.1
- b) maximum value = 3.62, minimum value = 1.1
- c) maximum value = 2.30, minimum value = 0
- d) maximum value = 3.62, minimum value = 0
- e) maximum value = 1.32, minimum value = 1

- 19. Find the derivative of the function  $f(x) = \tan(xe^x)$ .
  - a)  $(1+x)e^x \sec^2(xe^x)$

b)  $e^x \sec^2(xe^x)$ 

c)  $(1+x)e^x \tan(xe^x)$ 

d)  $e^x \cos^2(xe^x)$ 

- e)  $\sec^2(xe^x)$
- 20. If  $f'(x) = \frac{1}{2\sqrt{x}}$  and f(9) = 5
  - a)  $f(x) = \frac{3}{4}x^{-3/2} + \frac{11}{4}$

b)  $f(x) = \sqrt{x} + \frac{7}{2}$ 

c)  $f(x) = \frac{1}{2}\sqrt{x} + 3$ 

d)  $f(x) = \frac{1}{2}\sqrt{x} + \frac{7}{2}$ 

- e)  $f(x) = \sqrt{x} + 2$
- 21. A particle moves along a wire with velocity  $v(t) = 4\cos(2t)$ . Find the net change in position between time t = 0 and  $t = \pi$ 
  - a)  $1 + \pi$

b)  $2\pi$ 

c)  $4\pi$ 

d) 0

- e)  $\frac{\pi}{2}$
- 22. Alex wants to make a box with a square base, closed on all sides. He has 600 square inches of cardboard. What is the maximum volume of the box in cubic inches?
  - a) 598.32

b) 643.60

c) 1000

d) 1284.81

- e) 1500
- 23. Calculate the indefinite integral  $\int \frac{1}{x} + \sec(3x)\tan(3x) dx$ 
  - a)  $\ln|x| + 3\sec(3x) + C$

b)  $\frac{2}{x^2} + \frac{1}{3}\sec(3x) + C$ 

c)  $\ln |x| + \frac{1}{3}\sec(3x) + C$ 

d)  $-\frac{2}{x^2} + \frac{1}{3}\tan(3x) + C$ 

e)  $\ln |x| + \frac{1}{3}\cot(3x) + C$ 

- 24. Use the fundamental theorem of calculus to find the derivative of  $f(x) = \int_{1}^{x^2} \sin(\cos(t)) dt$ 
  - a)  $\sin(\cos(x^2))$

b)  $x^2 \sin(\cos(x^2))$ 

c)  $(x^2 - 1)\sin(\cos(x^2))$ 

d)  $2x\sin(\cos(x^2))$ 

- e)  $(2x-1)\sin(\cos(x))$
- 25. Use the geometric shape of the graph to find the integral  $\int_{-3}^{2} f(x)$  where

$$f(x) = \begin{cases} 5, & x \le 0\\ \sqrt{4 - x^2}, & x > 0 \end{cases}$$

a)  $2\pi$ 

b)  $\frac{15}{2} + \frac{1}{4}\pi$ 

c)  $15 + \pi$ 

d)  $15 + 2\pi$ 

- e)  $10 + \frac{\pi}{2}$
- 26. The acceleration of a particle is given by  $a(t) = 6\sin(t)$ . The position of the particle at time t = 0 is s(0) = 3. The initial velocity of the particle is v(0) = -7. The position function for the particle is
  - a)  $s(t) = -3t^2 + 5t + 3$

b)  $s(t) = -6\sin(t) - t + 3$ 

c)  $s(t) = -6\cos(t) - t + 6$ 

d)  $s(t) = -6\cos(t) - 13t + 3$ 

- e)  $s(t) = -6\sin(t) 13t + 3$
- 27. Calculate  $\int_{1}^{e^3} \frac{(\ln(x))^2}{x} dx.$ 
  - a) 9

b)  $\frac{1}{3}e^3 - 1$ 

c)  $2e^{-3}$ 

d)  $\frac{1}{3}$ 

- e) 8
- 28. Calculate the area between the curves y = x and  $y = x^2$ .
  - a)  $\frac{1}{3}$

b)  $\frac{1}{6}$ 

c)  $\frac{2}{3}$ 

d) 1

e)  $-\frac{1}{2}$ 

- 29. What is the average value of the function  $f(x) = \sin(x)$  on  $[0, \pi]$ 
  - a) 2

b)  $-2\pi$ 

c)  $-\frac{\pi}{2}$ 

d)  $\pi$ 

- e)  $\frac{2}{\pi}$
- 30. Find the inverse function to  $f(x) = \ln(x+2) \ln(x-3) + 7$ .
  - a)  $\frac{-2e^{x-7}-3}{-e^{x-7}-1}$

b)  $\frac{-3e^{x-7}-2}{-e^{x-7}-1}$ 

c)  $\frac{-3e^{x-7}-2}{-e^{x-7}+1}$ 

d)  $\frac{-2e^{x-1} - 3}{-e^{x-1} + 7}$ 

e)  $\frac{-2e^{x-3}-2}{-e^{x-3}-7}$