

King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics

**Calculus I**  
**FINAL EXAM**  
**Semester I, Term 081**  
**Monday February 02, 2009**

**EXAM COVER**

**Number of versions: 4**  
**Number of questions: 28**  
**Number of Answers: 5 per question**

This exam was prepared using mcqs  
For questions send an email to Dr. Ibrahim Al-Lehyani (iallehyani@kaau.edu.sa)

King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics

**Calculus I**  
**FINAL EXAM**  
Semester I, Term 081  
Monday February 02, 2009  
Net Time Allowed: 180 minutes

**MASTER VERSION**

1. If  $f''(x) = 6x - 30\sqrt{x}$ ,  $f(0) = 1$  and  $f'(0) = 2$ , then  $f(1) =$
- (a)  $-4$
  - (b)  $6$
  - (c)  $-2$
  - (d)  $8$
  - (e)  $-9$
2. Newton's Method is used to find a root of the equation  $x^3 + 2x - 4 = 0$ . If the first approximation is  $x_1 = 1$ , then the second approximation is  $x_2 =$
- (a)  $1.20$
  - (b)  $1.25$
  - (c)  $1.45$
  - (d)  $1.40$
  - (e)  $1.35$

3. The sum of all critical numbers of the function  $f(x) = (x^2 + 3x + 2)^{4/5}$  is

(a)  $-\frac{9}{2}$

(b)  $-3$

(c)  $-\frac{5}{2}$

(d)  $-\frac{7}{2}$

(e)  $-\frac{3}{2}$

4. If  $f(x) = \frac{1}{3(2-x)}$ , then  $f^{(4)}(-2) =$

(a)  $2^{-7}$

(b)  $2^{-5}$

(c)  $2^{-10}$

(d)  $2^{-13}$

(e)  $2^{-3}$

5. The asymptotes of the curve  $y = \frac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$  are
- (a) one horizontal and one vertical asymptotes
  - (b) one horizontal and three vertical asymptotes
  - (c) one horizontal and two vertical asymptotes
  - (d) one slant and one vertical asymptotes
  - (e) one horizontal, one slant, and one vertical asymptotes
6. A particle moves on a straight line with acceleration given by  $a(t) = 10 \sin t + 3 \cos t$ . If  $v(t)$  is its velocity function such that  $v(0) = -6$  cm/sec., then  $v(\pi) =$
- (a) 14 cm/sec.
  - (b)  $-3$  cm/sec.
  - (c) 13 cm/sec.
  - (d)  $-7$  cm/sec.
  - (e) 3 cm/sec.

7.  $\lim_{x \rightarrow 0} \frac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

(a)  $-\frac{4}{3}$

(b)  $-\frac{5}{6}$

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

(d)  $-\frac{1}{6}$

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

8. If  $f(x) = \begin{cases} ax^2 + bx + 2, & x \leq 1/2 \\ 2ax - b, & x > 1/2 \end{cases}$  is a continuous function, then  $3a - 6b =$

(a) 8

(b) -2

(c) 6

(d) -1

(e) 10

9. Using the first derivative test, the function  $f(x) = x^4(x - 1)^3$  has
- (a) one local maximum and one local minimum
  - (b) one local maximum and no local minimum
  - (c) one local minimum and no local maximum
  - (d) two local maxima and one local minimum
  - (e) two local minima and one local maximum
10. The graph of the function  $f(x) = \cos^2 x - 2 \sin x$ ,  $0 < x < 2\pi$ , is decreasing on
- (a)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$
  - (b)  $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$
  - (c)  $(\pi, 2\pi)$
  - (d)  $\left(\frac{\pi}{2}, \pi\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$
  - (e)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\pi, \frac{3\pi}{2}\right)$

11. The slope of the tangent line to the graph of  $y = \tanh^{-1} \sqrt{x}$  at  $x = \frac{1}{4}$  is

(a)  $\frac{4}{3}$

(b)  $\frac{3}{5}$

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

(d)  $\frac{1}{2}$

(e) 1

12. Using differentials (or equivalently, a linear approximation), the value of  $\sqrt{0.17}$  is approximately equal to

(a)  $\frac{33}{80}$

(b)  $\frac{37}{80}$

(c)  $\frac{17}{40}$

(d)  $\frac{9}{20}$

(e)  $\frac{13}{40}$



13. The linearization  $L(x)$  of the function  $f(x) = e^{-\sqrt{2x+1}}$  at  $a = 0$  is given by

(a)  $L(x) = \frac{1}{e}(1 - x)$

(b)  $L(x) = \frac{1}{e}(1 + 2x)$

(c)  $L(x) = -\frac{1}{e}(1 + 2x)$

(d)  $L(x) = \frac{1}{e}(2 - x)$

(e)  $L(x) = 1 - \frac{1}{2e}x$

14. A ladder 3 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of  $\frac{1}{4}$  ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is  $\sqrt{5}$  ft from the wall?

(a)  $-\frac{\sqrt{5}}{8}$  ft/s

(b)  $\frac{\sqrt{5}}{2}$  ft/s

(c)  $-\frac{\sqrt{5}}{2}$  ft/s

(d)  $2\sqrt{5}$  ft/s

(e)  $-2\sqrt{5}$  ft/s

15. If  $y = \ln\left(\frac{e^{-3}}{e^{2x} + e^{-2x}}\right)$ , then  $y' =$

(a)  $-2 \tanh(2x)$

(b)  $2 \sinh(2x)$

(c)  $-3 - 2 \cosh(2x)$

(d)  $-3 \tanh(2x)$

(e)  $-3 + 2 \sinh(2x)$

16. If  $f(x) = x^{\ln x}$ , then  $f'(e) =$

(a) 2

(b)  $\frac{2}{e}$

(c) 1

(d)  $\frac{1}{e}$

(e) 0

17. The number of points of inflection of the curve  $f(x) = x^5 - 5x^4$  is
- (a) 1
  - (b) 2
  - (c) 3
  - (d) 4
  - (e) 0
18. The slope of the tangent line to the graph of  $x \tan^{-1} y = \frac{\pi}{4} y$  at the point  $(1, 1)$  is
- (a)  $\frac{\pi}{\pi - 2}$
  - (b)  $\frac{\pi}{2}$
  - (c) 1
  - (d)  $\frac{\pi + 2}{\pi - 2}$
  - (e)  $\frac{3\pi}{\pi - 2}$

19. If  $f(x) = \tan\left(x + \frac{\pi}{2} \sin 2x\right)$ , then  $f'\left(\frac{\pi}{4}\right) =$

(a) 2

(b) 1

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

(d) 4

(e) 0

20. The sum of all values of  $x$ ,  $0 \leq x \leq 3\pi$ , at which the graph of  $f(x) = \frac{\sin x}{2 - \cos x}$  has horizontal tangents, is

(a)  $\frac{13\pi}{3}$

(b)  $3\pi$

(c)  $\frac{10\pi}{3}$

(d)  $\frac{3\pi}{2}$

(e)  $\frac{16\pi}{3}$

21. If  $f''(x) = \frac{-2}{x^{4/3}(9-x)^{5/3}}$ , then which one of the following statements is **TRUE** about the concavity of the curve  $y = f(x)$ ?

[ $CU \equiv$  concave upward,  $CD \equiv$  concave downward]

- (a)  $CU$  on  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$  and  $(0, 9)$
- (b)  $CU$  on  $(-\infty, 0)$  and  $(9, \infty)$ ; and  $CD$  on  $(0, 9)$
- (c)  $CU$  on  $(-\infty, 0)$  and  $(0, 9)$ ; and  $CD$  on  $(9, \infty)$
- (d)  $CU$  on  $(0, 9)$  and  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$
- (e)  $CU$  on  $(-\infty, 0)$ ; and  $CD$  on  $(0, 9)$  and  $(9, \infty)$
22. If  $y = mx + c$  is the equation of the slant asymptote of the curve  $y = \frac{3x^4 + 2x + 1}{2x^3 + 8x^2}$ , then  $m + c =$

- (a)  $-\frac{9}{2}$
- (b) 3
- (c)  $\frac{11}{2}$
- (d) -3
- (e)  $-\frac{3}{2}$

23. If a box with a square base and open top must have a volume of  $4000 \text{ cm}^3$ , then the minimum surface area of such a box is
- (a)  $1200 \text{ cm}^2$
  - (b)  $800 \text{ cm}^2$
  - (c)  $1400 \text{ cm}^2$
  - (d)  $1600 \text{ cm}^2$
  - (e)  $1800 \text{ cm}^2$
24. If  $M$  and  $m$  are the absolute maximum and the absolute minimum, respectively, of the function  $f(x) = x\sqrt{4-x^2}$  on  $[-1, 2]$ , then  $\sqrt{3}M + 4m =$
- (a)  $-2\sqrt{3}$
  - (b)  $\sqrt{3}$
  - (c)  $-3\sqrt{3}$
  - (d)  $3$
  - (e)  $-3$

25.  $\lim_{x \rightarrow 0^+} (1 + \sin 4x)^{\cot 3x} =$

(a)  $e^{4/3}$

(b)  $e^{3/4}$

(c)  $e^{12}$

(d)  $\infty$

(e) 1

26. The equation of the **horizontal asymptote** to the graph of  $f(x) = 3x + \sqrt{9x^2 + 12x}$  is

(a)  $y = -2$

(b)  $y = 0$

(c)  $y = -\frac{1}{3}$

(d)  $y = \frac{1}{6}$

(e)  $y = -3$

27. Suppose  $f$  is continuous on  $[0, 4]$ ,  $f(0) = 1$  and  $2 \leq f'(x) \leq 5$  for all  $x$  in  $(0, 4)$ , then

(a)  $9 \leq f(4) \leq 21$

(b)  $7 \leq f(4) \leq 19$

(c)  $3 \leq f(4) \leq 6$

(d)  $\frac{3}{2} \leq f(4) \leq \frac{9}{4}$

(e)  $4 \leq f(4) \leq 11$

28. Let  $f(x) = \frac{1}{2} + \frac{3}{2}x$  and  $\epsilon = 0.006$ . The largest value of  $\delta$  such that  $|f(x) + 1| < \epsilon$  whenever  $|x + 1| < \delta$  is

(a) 0.004

(b) 0.003

(c) 0.005

(d) 0.001

(e) 0.002



King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics

CODE 001

Calculus I  
FINAL EXAM

CODE 001

Semester I, Term 081  
Monday February 02, 2009  
Net Time Allowed: 180 minutes

Name: \_\_\_\_\_

ID: \_\_\_\_\_ Sec: \_\_\_\_\_.

**Check that this exam has 28 questions.**

**Important Instructions:**

1. All types of calculators, pagers or mobile phones are NOT allowed during the examination.
2. Use HB 2.5 pencils only.
3. Use a good eraser. DO NOT use the erasers attached to the pencil.
4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1. If  $y = \ln\left(\frac{e^{-3}}{e^{2x} + e^{-2x}}\right)$ , then  $y' =$

(a)  $-3 + 2 \sinh(2x)$

(b)  $2 \sinh(2x)$

(c)  $-3 \tanh(2x)$

(d)  $-2 \tanh(2x)$

(e)  $-3 - 2 \cosh(2x)$

2. If  $f(x) = \begin{cases} ax^2 + bx + 2, & x \leq 1/2 \\ 2ax - b, & x > 1/2 \end{cases}$  is a continuous function, then  $3a - 6b =$

(a) 8

(b) 10

(c) 6

(d) -1

(e) -2

3. The sum of all critical numbers of the function  $f(x) = (x^2 + 3x + 2)^{4/5}$  is

(a)  $-\frac{7}{2}$

(b)  $-\frac{5}{2}$

(c)  $-\frac{9}{2}$

(d)  $-\frac{3}{2}$

(e)  $-3$

4. If  $f''(x) = 6x - 30\sqrt{x}$ ,  $f(0) = 1$  and  $f'(0) = 2$ , then  $f(1) =$

(a)  $-9$

(b)  $8$

(c)  $-4$

(d)  $6$

(e)  $-2$

5.  $\lim_{x \rightarrow 0} \frac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

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

(b)  $-\frac{5}{6}$

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

(d)  $-\frac{1}{6}$

(e)  $-\frac{4}{3}$

6. Using differentials (or equivalently, a linear approximation), the value of  $\sqrt{0.17}$  is approximately equal to

(a)  $\frac{17}{40}$

(b)  $\frac{13}{40}$

(c)  $\frac{9}{20}$

(d)  $\frac{37}{80}$

(e)  $\frac{33}{80}$

7. The slope of the tangent line to the graph of  $x \tan^{-1} y = \frac{\pi}{4} y$  at the point  $(1, 1)$  is

(a)  $\frac{\pi + 2}{\pi - 2}$

(b) 1

(c)  $\frac{3\pi}{\pi - 2}$

(d)  $\frac{\pi}{2}$

(e)  $\frac{\pi}{\pi - 2}$

8. A particle moves on a straight line with acceleration given by  $a(t) = 10 \sin t + 3 \cos t$ . If  $v(t)$  is its velocity function such that  $v(0) = -6$  cm/sec., then  $v(\pi) =$

(a) 13 cm/sec.

(b)  $-7$  cm/sec.

(c)  $-3$  cm/sec.

(d) 3 cm/sec.

(e) 14 cm/sec.

9. If  $y = mx + c$  is the equation of the slant asymptote of the curve  $y = \frac{3x^4 + 2x + 1}{2x^3 + 8x^2}$ , then  $m + c =$

(a)  $-3$

(b)  $-\frac{9}{2}$

(c)  $3$

(d)  $-\frac{3}{2}$

(e)  $\frac{11}{2}$

10. If  $f''(x) = \frac{-2}{x^{4/3}(9-x)^{5/3}}$ , then which one of the following statements is **TRUE** about the concavity of the curve  $y = f(x)$ ?

[ $CU \equiv$  concave upward,  $CD \equiv$  concave downward]

(a)  $CU$  on  $(-\infty, 0)$  and  $(0, 9)$ ; and  $CD$  on  $(9, \infty)$

(b)  $CU$  on  $(0, 9)$  and  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$

(c)  $CU$  on  $(-\infty, 0)$ ; and  $CD$  on  $(0, 9)$  and  $(9, \infty)$

(d)  $CU$  on  $(-\infty, 0)$  and  $(9, \infty)$ ; and  $CD$  on  $(0, 9)$

(e)  $CU$  on  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$  and  $(0, 9)$

11. The asymptotes of the curve  $y = \frac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$  are
- (a) one horizontal and one vertical asymptotes
  - (b) one slant and one vertical asymptotes
  - (c) one horizontal, one slant, and one vertical asymptotes
  - (d) one horizontal and three vertical asymptotes
  - (e) one horizontal and two vertical asymptotes
12. A ladder 3 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of  $\frac{1}{4}$  ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is  $\sqrt{5}$  ft from the wall?
- (a)  $-\frac{\sqrt{5}}{8}$  ft/s
  - (b)  $\frac{\sqrt{5}}{2}$  ft/s
  - (c)  $2\sqrt{5}$  ft/s
  - (d)  $-\frac{\sqrt{5}}{2}$  ft/s
  - (e)  $-2\sqrt{5}$  ft/s

13. If  $f(x) = \frac{1}{3(2-x)}$ , then  $f^{(4)}(-2) =$

(a)  $2^{-13}$

(b)  $2^{-7}$

(c)  $2^{-10}$

(d)  $2^{-5}$

(e)  $2^{-3}$

14. If  $f(x) = x^{\ln x}$ , then  $f'(e) =$

(a)  $\frac{2}{e}$

(b)  $\frac{1}{e}$

(c) 0

(d) 1

(e) 2



15. The graph of the function  $f(x) = \cos^2 x - 2 \sin x$ ,  $0 < x < 2\pi$ , is decreasing on

(a)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\pi, \frac{3\pi}{2}\right)$

(b)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$

(c)  $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

(d)  $(\pi, 2\pi)$

(e)  $\left(\frac{\pi}{2}, \pi\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$

16. The linearization  $L(x)$  of the function  $f(x) = e^{-\sqrt{2x+1}}$  at  $a = 0$  is given by

(a)  $L(x) = \frac{1}{e}(1 - x)$

(b)  $L(x) = \frac{1}{e}(2 - x)$

(c)  $L(x) = 1 - \frac{1}{2e}x$

(d)  $L(x) = \frac{1}{e}(1 + 2x)$

(e)  $L(x) = -\frac{1}{e}(1 + 2x)$

17. The slope of the tangent line to the graph of  $y = \tanh^{-1} \sqrt{x}$  at  $x = \frac{1}{4}$  is
- (a)  $\frac{1}{2}$
  - (b)  $\frac{4}{3}$
  - (c)  $\frac{3}{5}$
  - (d) 1
  - (e)  $\frac{2}{3}$
18. Using the first derivative test, the function  $f(x) = x^4(x - 1)^3$  has
- (a) one local minimum and no local maximum
  - (b) two local minima and one local maximum
  - (c) one local maximum and no local minimum
  - (d) one local maximum and one local minimum
  - (e) two local maxima and one local minimum

19. The sum of all values of  $x$ ,  $0 \leq x \leq 3\pi$ , at which the graph of  $f(x) = \frac{\sin x}{2 - \cos x}$  has horizontal tangents, is

(a)  $\frac{13\pi}{3}$

(b)  $\frac{16\pi}{3}$

(c)  $\frac{10\pi}{3}$

(d)  $\frac{3\pi}{2}$

(e)  $3\pi$

20. If  $f(x) = \tan\left(x + \frac{\pi}{2} \sin 2x\right)$ , then  $f'\left(\frac{\pi}{4}\right) =$

(a) 0

(b) 1

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

(d) 2

(e) 4

21. The number of points of inflection of the curve  $f(x) = x^5 - 5x^4$  is
- (a) 2
  - (b) 4
  - (c) 0
  - (d) 3
  - (e) 1
22. Newton's Method is used to find a root of the equation  $x^3 + 2x - 4 = 0$ . If the first approximation is  $x_1 = 1$ , then the second approximation is  $x_2 =$
- (a) 1.25
  - (b) 1.20
  - (c) 1.35
  - (d) 1.40
  - (e) 1.45

23. If  $M$  and  $m$  are the absolute maximum and the absolute minimum, respectively, of the function  $f(x) = x\sqrt{4-x^2}$  on  $[-1, 2]$ , then  $\sqrt{3}M + 4m =$

(a)  $-2\sqrt{3}$

(b)  $-3\sqrt{3}$

(c)  $-3$

(d)  $3$

(e)  $\sqrt{3}$

24. If a box with a square base and open top must have a volume of  $4000 \text{ cm}^3$ , then the minimum surface area of such a box is

(a)  $800 \text{ cm}^2$

(b)  $1400 \text{ cm}^2$

(c)  $1200 \text{ cm}^2$

(d)  $1600 \text{ cm}^2$

(e)  $1800 \text{ cm}^2$

25. Suppose  $f$  is continuous on  $[0, 4]$ ,  $f(0) = 1$  and  $2 \leq f'(x) \leq 5$  for all  $x$  in  $(0, 4)$ , then

(a)  $9 \leq f(4) \leq 21$

(b)  $3 \leq f(4) \leq 6$

(c)  $7 \leq f(4) \leq 19$

(d)  $\frac{3}{2} \leq f(4) \leq \frac{9}{4}$

(e)  $4 \leq f(4) \leq 11$

26. The equation of the **horizontal asymptote** to the graph of  $f(x) = 3x + \sqrt{9x^2 + 12x}$  is

(a)  $y = -\frac{1}{3}$

(b)  $y = -3$

(c)  $y = -2$

(d)  $y = \frac{1}{6}$

(e)  $y = 0$

27. Let  $f(x) = \frac{1}{2} + \frac{3}{2}x$  and  $\epsilon = 0.006$ . The largest value of  $\delta$  such that  $|f(x) + 1| < \epsilon$  whenever  $|x + 1| < \delta$  is

(a) 0.005

(b) 0.003

(c) 0.002

(d) 0.001

(e) 0.004

28.  $\lim_{x \rightarrow 0^+} (1 + \sin 4x)^{\cot 3x} =$

(a) 1

(b)  $e^{12}$

(c)  $\infty$

(d)  $e^{4/3}$

(e)  $e^{3/4}$

Name .....

ID .....

Sec .....

1	a	b	c	d	e	f
2	a	b	c	d	e	f
3	a	b	c	d	e	f
4	a	b	c	d	e	f
5	a	b	c	d	e	f
6	a	b	c	d	e	f
7	a	b	c	d	e	f
8	a	b	c	d	e	f
9	a	b	c	d	e	f
10	a	b	c	d	e	f
11	a	b	c	d	e	f
12	a	b	c	d	e	f
13	a	b	c	d	e	f
14	a	b	c	d	e	f
15	a	b	c	d	e	f
16	a	b	c	d	e	f
17	a	b	c	d	e	f
18	a	b	c	d	e	f
19	a	b	c	d	e	f
20	a	b	c	d	e	f
21	a	b	c	d	e	f
22	a	b	c	d	e	f
23	a	b	c	d	e	f
24	a	b	c	d	e	f
25	a	b	c	d	e	f
26	a	b	c	d	e	f
27	a	b	c	d	e	f
28	a	b	c	d	e	f
29	a	b	c	d	e	f
30	a	b	c	d	e	f
31	a	b	c	d	e	f
32	a	b	c	d	e	f
33	a	b	c	d	e	f
34	a	b	c	d	e	f
35	a	b	c	d	e	f

36	a	b	c	d	e	f
37	a	b	c	d	e	f
38	a	b	c	d	e	f
39	a	b	c	d	e	f
40	a	b	c	d	e	f
41	a	b	c	d	e	f
42	a	b	c	d	e	f
43	a	b	c	d	e	f
44	a	b	c	d	e	f
45	a	b	c	d	e	f
46	a	b	c	d	e	f
47	a	b	c	d	e	f
48	a	b	c	d	e	f
49	a	b	c	d	e	f
50	a	b	c	d	e	f
51	a	b	c	d	e	f
52	a	b	c	d	e	f
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67	a	b	c	d	e	f
68	a	b	c	d	e	f
69	a	b	c	d	e	f
70	a	b	c	d	e	f



King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics

**CODE 002**

**Calculus I  
FINAL EXAM**

**CODE 002**

**Semester I, Term 081  
Monday February 02, 2009  
Net Time Allowed: 180 minutes**

Name: \_\_\_\_\_

ID: \_\_\_\_\_ Sec: \_\_\_\_\_.

**Check that this exam has 28 questions.**

**Important Instructions:**

1. All types of calculators, pagers or mobile phones are NOT allowed during the examination.
2. Use HB 2.5 pencils only.
3. Use a good eraser. DO NOT use the erasers attached to the pencil.
4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1. Using differentials (or equivalently, a linear approximation), the value of  $\sqrt{0.17}$  is approximately equal to

(a)  $\frac{13}{40}$

(b)  $\frac{17}{40}$

(c)  $\frac{33}{80}$

(d)  $\frac{37}{80}$

(e)  $\frac{9}{20}$

2. If  $y = \ln\left(\frac{e^{-3}}{e^{2x} + e^{-2x}}\right)$ , then  $y' =$

(a)  $-2 \tanh(2x)$

(b)  $-3 \tanh(2x)$

(c)  $-3 + 2 \sinh(2x)$

(d)  $-3 - 2 \cosh(2x)$

(e)  $2 \sinh(2x)$

3. The number of points of inflection of the curve  $f(x) = x^5 - 5x^4$  is
- (a) 4
  - (b) 1
  - (c) 3
  - (d) 0
  - (e) 2
4. The sum of all critical numbers of the function  $f(x) = (x^2 + 3x + 2)^{4/5}$  is
- (a)  $-\frac{7}{2}$
  - (b)  $-\frac{5}{2}$
  - (c)  $-\frac{3}{2}$
  - (d)  $-3$
  - (e)  $-\frac{9}{2}$

5. The graph of the function  $f(x) = \cos^2 x - 2 \sin x$ ,  $0 < x < 2\pi$ , is decreasing on

(a)  $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

(b)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\pi, \frac{3\pi}{2}\right)$

(c)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$

(d)  $\left(\frac{\pi}{2}, \pi\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$

(e)  $(\pi, 2\pi)$

6. If  $f''(x) = \frac{-2}{x^{4/3}(9-x)^{5/3}}$ , then which one of the following statements is **TRUE** about the concavity of the curve  $y = f(x)$ ?

[ $CU \equiv$  concave upward,  $CD \equiv$  concave downward]

(a)  $CU$  on  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$  and  $(0, 9)$

(b)  $CU$  on  $(-\infty, 0)$ ; and  $CD$  on  $(0, 9)$  and  $(9, \infty)$

(c)  $CU$  on  $(-\infty, 0)$  and  $(9, \infty)$ ; and  $CD$  on  $(0, 9)$

(d)  $CU$  on  $(-\infty, 0)$  and  $(0, 9)$ ; and  $CD$  on  $(9, \infty)$

(e)  $CU$  on  $(0, 9)$  and  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$

7. The asymptotes of the curve  $y = \frac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$  are
- (a) one horizontal, one slant, and one vertical asymptotes
  - (b) one horizontal and one vertical asymptotes
  - (c) one horizontal and two vertical asymptotes
  - (d) one slant and one vertical asymptotes
  - (e) one horizontal and three vertical asymptotes
8. The linearization  $L(x)$  of the function  $f(x) = e^{-\sqrt{2x+1}}$  at  $a = 0$  is given by
- (a)  $L(x) = 1 - \frac{1}{2e}x$
  - (b)  $L(x) = \frac{1}{e}(2 - x)$
  - (c)  $L(x) = \frac{1}{e}(1 - x)$
  - (d)  $L(x) = \frac{1}{e}(1 + 2x)$
  - (e)  $L(x) = -\frac{1}{e}(1 + 2x)$

9.  $\lim_{x \rightarrow 0} \frac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

(a)  $-\frac{1}{6}$

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

(c)  $-\frac{5}{6}$

(d)  $-\frac{3}{2}$

(e)  $-\frac{4}{3}$

10. If  $f(x) = \begin{cases} ax^2 + bx + 2, & x \leq 1/2 \\ 2ax - b, & x > 1/2 \end{cases}$  is a continuous function, then  $3a - 6b =$

(a)  $-2$

(b)  $8$

(c)  $-1$

(d)  $6$

(e)  $10$

11. A ladder 3 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of  $\frac{1}{4}$  ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is  $\sqrt{5}$  ft from the wall?
- (a)  $2\sqrt{5}$  ft/s
- (b)  $-\frac{\sqrt{5}}{8}$  ft/s
- (c)  $-\frac{\sqrt{5}}{2}$  ft/s
- (d)  $\frac{\sqrt{5}}{2}$  ft/s
- (e)  $-2\sqrt{5}$  ft/s
12. If  $f''(x) = 6x - 30\sqrt{x}$ ,  $f(0) = 1$  and  $f'(0) = 2$ , then  $f(1) =$
- (a)  $-9$
- (b)  $6$
- (c)  $8$
- (d)  $-2$
- (e)  $-4$

13. If  $f(x) = x^{\ln x}$ , then  $f'(e) =$

(a)  $\frac{1}{e}$

(b) 0

(c) 1

(d)  $\frac{2}{e}$

(e) 2

14. The slope of the tangent line to the graph of  $y = \tanh^{-1} \sqrt{x}$  at  $x = \frac{1}{4}$  is

(a)  $\frac{3}{5}$

(b)  $\frac{2}{3}$

(c) 1

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

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



15. If  $y = mx + c$  is the equation of the slant asymptote of the curve  $y = \frac{3x^4 + 2x + 1}{2x^3 + 8x^2}$ , then  $m + c =$

(a)  $\frac{11}{2}$

(b)  $-\frac{9}{2}$

(c) 3

(d)  $-\frac{3}{2}$

(e) -3

16. A particle moves on a straight line with acceleration given by  $a(t) = 10 \sin t + 3 \cos t$ . If  $v(t)$  is its velocity function such that  $v(0) = -6$  cm/sec., then  $v(\pi) =$

(a) 14 cm/sec.

(b) 13 cm/sec.

(c) -3 cm/sec.

(d) 3 cm/sec.

(e) -7 cm/sec.

17. If  $f(x) = \frac{1}{3(2-x)}$ , then  $f^{(4)}(-2) =$

(a)  $2^{-7}$

(b)  $2^{-10}$

(c)  $2^{-13}$

(d)  $2^{-5}$

(e)  $2^{-3}$

18. Using the first derivative test, the function  $f(x) = x^4(x-1)^3$  has

(a) one local maximum and no local minimum

(b) two local minima and one local maximum

(c) two local maxima and one local minimum

(d) one local maximum and one local minimum

(e) one local minimum and no local maximum

19. If  $f(x) = \tan\left(x + \frac{\pi}{2} \sin 2x\right)$ , then  $f'\left(\frac{\pi}{4}\right) =$

(a) 0

(b) 4

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

(d) 2

(e) 1

20. The sum of all values of  $x$ ,  $0 \leq x \leq 3\pi$ , at which the graph of  $f(x) = \frac{\sin x}{2 - \cos x}$  has horizontal tangents, is

(a)  $\frac{3\pi}{2}$

(b)  $\frac{13\pi}{3}$

(c)  $3\pi$

(d)  $\frac{10\pi}{3}$

(e)  $\frac{16\pi}{3}$

21. Newton's Method is used to find a root of the equation  $x^3 + 2x - 4 = 0$ . If the first approximation is  $x_1 = 1$ , then the second approximation is  $x_2 =$
- (a) 1.45
  - (b) 1.20
  - (c) 1.40
  - (d) 1.35
  - (e) 1.25
22. The slope of the tangent line to the graph of  $x \tan^{-1} y = \frac{\pi}{4} y$  at the point  $(1, 1)$  is
- (a)  $\frac{\pi}{\pi - 2}$
  - (b)  $\frac{\pi}{2}$
  - (c) 1
  - (d)  $\frac{3\pi}{\pi - 2}$
  - (e)  $\frac{\pi + 2}{\pi - 2}$

23. The equation of the **horizontal asymptote** to the graph of  $f(x) = 3x + \sqrt{9x^2 + 12x}$  is

(a)  $y = -2$

(b)  $y = 0$

(c)  $y = -\frac{1}{3}$

(d)  $y = \frac{1}{6}$

(e)  $y = -3$

24. If a box with a square base and open top must have a volume of  $4000 \text{ cm}^3$ , then the minimum surface area of such a box is

(a)  $1800 \text{ cm}^2$

(b)  $1400 \text{ cm}^2$

(c)  $1600 \text{ cm}^2$

(d)  $800 \text{ cm}^2$

(e)  $1200 \text{ cm}^2$

25. Let  $f(x) = \frac{1}{2} + \frac{3}{2}x$  and  $\epsilon = 0.006$ . The largest value of  $\delta$  such that  $|f(x) + 1| < \epsilon$  whenever  $|x + 1| < \delta$  is
- (a) 0.003
  - (b) 0.004
  - (c) 0.001
  - (d) 0.005
  - (e) 0.002
26. If  $M$  and  $m$  are the absolute maximum and the absolute minimum, respectively, of the function  $f(x) = x\sqrt{4 - x^2}$  on  $[-1, 2]$ , then  $\sqrt{3}M + 4m =$
- (a)  $-3\sqrt{3}$
  - (b) 3
  - (c) -3
  - (d)  $\sqrt{3}$
  - (e)  $-2\sqrt{3}$

27.  $\lim_{x \rightarrow 0^+} (1 + \sin 4x)^{\cot 3x} =$

(a) 1

(b)  $e^{3/4}$

(c)  $\infty$

(d)  $e^{12}$

(e)  $e^{4/3}$

28. Suppose  $f$  is continuous on  $[0, 4]$ ,  $f(0) = 1$  and  $2 \leq f'(x) \leq 5$  for all  $x$  in  $(0, 4)$ , then

(a)  $9 \leq f(4) \leq 21$

(b)  $\frac{3}{2} \leq f(4) \leq \frac{9}{4}$

(c)  $3 \leq f(4) \leq 6$

(d)  $7 \leq f(4) \leq 19$

(e)  $4 \leq f(4) \leq 11$

Name .....

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70	a	b	c	d	e	f



King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics

**CODE 003**

**Calculus I  
FINAL EXAM**

**CODE 003**

**Semester I, Term 081  
Monday February 02, 2009  
Net Time Allowed: 180 minutes**

Name: \_\_\_\_\_

ID: \_\_\_\_\_ Sec: \_\_\_\_\_.

**Check that this exam has 28 questions.**

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7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1. Using the first derivative test, the function  $f(x) = x^4(x - 1)^3$  has
- (a) one local maximum and no local minimum
  - (b) one local minimum and no local maximum
  - (c) two local minima and one local maximum
  - (d) one local maximum and one local minimum
  - (e) two local maxima and one local minimum
2. The slope of the tangent line to the graph of  $y = \tanh^{-1} \sqrt{x}$  at  $x = \frac{1}{4}$  is
- (a)  $\frac{4}{3}$
  - (b)  $\frac{3}{5}$
  - (c)  $\frac{2}{3}$
  - (d) 1
  - (e)  $\frac{1}{2}$

3. The asymptotes of the curve  $y = \frac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$  are
- (a) one horizontal, one slant, and one vertical asymptotes
  - (b) one horizontal and two vertical asymptotes
  - (c) one horizontal and three vertical asymptotes
  - (d) one horizontal and one vertical asymptotes
  - (e) one slant and one vertical asymptotes
4. The number of points of inflection of the curve  $f(x) = x^5 - 5x^4$  is
- (a) 2
  - (b) 4
  - (c) 0
  - (d) 1
  - (e) 3

5. The sum of all values of  $x$ ,  $0 \leq x \leq 3\pi$ , at which the graph of  $f(x) = \frac{\sin x}{2 - \cos x}$  has horizontal tangents, is

(a)  $\frac{10\pi}{3}$

(b)  $\frac{3\pi}{2}$

(c)  $\frac{13\pi}{3}$

(d)  $\frac{16\pi}{3}$

(e)  $3\pi$

6. The graph of the function  $f(x) = \cos^2 x - 2 \sin x$ ,  $0 < x < 2\pi$ , is decreasing on

(a)  $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

(b)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$

(c)  $\left(\frac{\pi}{2}, \pi\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$

(d)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\pi, \frac{3\pi}{2}\right)$

(e)  $(\pi, 2\pi)$

7. If  $f(x) = \begin{cases} ax^2 + bx + 2, & x \leq 1/2 \\ 2ax - b, & x > 1/2 \end{cases}$  is a continuous function, then  $3a - 6b =$

- (a)  $-1$
- (b)  $6$
- (c)  $8$
- (d)  $-2$
- (e)  $10$
8. A ladder 3 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of  $\frac{1}{4}$  ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is  $\sqrt{5}$  ft from the wall?

- (a)  $-2\sqrt{5}$  ft/s
- (b)  $-\frac{\sqrt{5}}{8}$  ft/s
- (c)  $-\frac{\sqrt{5}}{2}$  ft/s
- (d)  $2\sqrt{5}$  ft/s
- (e)  $\frac{\sqrt{5}}{2}$  ft/s

9.  $\lim_{x \rightarrow 0} \frac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

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

(b)  $-\frac{3}{2}$

(c)  $-\frac{5}{6}$

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

(e)  $-\frac{1}{6}$

10. If  $y = \ln\left(\frac{e^{-3}}{e^{2x} + e^{-2x}}\right)$ , then  $y' =$

(a)  $-3 + 2 \sinh(2x)$

(b)  $-3 \tanh(2x)$

(c)  $-3 - 2 \cosh(2x)$

(d)  $2 \sinh(2x)$

(e)  $-2 \tanh(2x)$

11. The sum of all critical numbers of the function  $f(x) = (x^2 + 3x + 2)^{4/5}$  is
- (a)  $-\frac{5}{2}$
  - (b)  $-\frac{9}{2}$
  - (c)  $-\frac{3}{2}$
  - (d)  $-\frac{7}{2}$
  - (e)  $-3$
12. If  $f(x) = x^{\ln x}$ , then  $f'(e) =$
- (a) 0
  - (b) 2
  - (c) 1
  - (d)  $\frac{2}{e}$
  - (e)  $\frac{1}{e}$

13. If  $f''(x) = 6x - 30\sqrt{x}$ ,  $f(0) = 1$  and  $f'(0) = 2$ , then  $f(1) =$

(a)  $-4$

(b)  $8$

(c)  $-2$

(d)  $-9$

(e)  $6$

14. If  $f(x) = \tan\left(x + \frac{\pi}{2} \sin 2x\right)$ , then  $f'\left(\frac{\pi}{4}\right) =$

(a)  $2$

(b)  $1$

(c)  $0$

(d)  $4$

(e)  $\frac{3}{2}$



15. If  $f''(x) = \frac{-2}{x^{4/3}(9-x)^{5/3}}$ , then which one of the following statements is TRUE about the concavity of the curve  $y = f(x)$ ?

[ $CU \equiv$  concave upward,  $CD \equiv$  concave downward]

- (a)  $CU$  on  $(-\infty, 0)$  and  $(9, \infty)$ ; and  $CD$  on  $(0, 9)$
- (b)  $CU$  on  $(-\infty, 0)$ ; and  $CD$  on  $(0, 9)$  and  $(9, \infty)$
- (c)  $CU$  on  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$  and  $(0, 9)$
- (d)  $CU$  on  $(-\infty, 0)$  and  $(0, 9)$ ; and  $CD$  on  $(9, \infty)$
- (e)  $CU$  on  $(0, 9)$  and  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$
16. If  $y = mx + c$  is the equation of the slant asymptote of the curve  $y = \frac{3x^4 + 2x + 1}{2x^3 + 8x^2}$ , then  $m + c =$

- (a)  $-3$
- (b)  $\frac{11}{2}$
- (c)  $-\frac{9}{2}$
- (d)  $-\frac{3}{2}$
- (e)  $3$

17. Using differentials (or equivalently, a linear approximation), the value of  $\sqrt{0.17}$  is approximately equal to
- (a)  $\frac{9}{20}$
  - (b)  $\frac{33}{80}$
  - (c)  $\frac{13}{40}$
  - (d)  $\frac{37}{80}$
  - (e)  $\frac{17}{40}$
18. The slope of the tangent line to the graph of  $x \tan^{-1} y = \frac{\pi}{4} y$  at the point  $(1, 1)$  is
- (a) 1
  - (b)  $\frac{3\pi}{\pi - 2}$
  - (c)  $\frac{\pi}{\pi - 2}$
  - (d)  $\frac{\pi}{2}$
  - (e)  $\frac{\pi + 2}{\pi - 2}$

19. A particle moves on a straight line with acceleration given by  $a(t) = 10 \sin t + 3 \cos t$ . If  $v(t)$  is its velocity function such that  $v(0) = -6$  cm/sec., then  $v(\pi) =$
- (a) 14 cm/sec.
  - (b)  $-7$  cm/sec.
  - (c) 13 cm/sec.
  - (d) 3 cm/sec.
  - (e)  $-3$  cm/sec.
20. Newton's Method is used to find a root of the equation  $x^3 + 2x - 4 = 0$ . If the first approximation is  $x_1 = 1$ , then the second approximation is  $x_2 =$
- (a) 1.25
  - (b) 1.35
  - (c) 1.45
  - (d) 1.20
  - (e) 1.40

21. If  $f(x) = \frac{1}{3(2-x)}$ , then  $f^{(4)}(-2) =$

(a)  $2^{-13}$

(b)  $2^{-5}$

(c)  $2^{-3}$

(d)  $2^{-7}$

(e)  $2^{-10}$

22. The linearization  $L(x)$  of the function  $f(x) = e^{-\sqrt{2x+1}}$  at  $a = 0$  is given by

(a)  $L(x) = \frac{1}{e}(2-x)$

(b)  $L(x) = \frac{1}{e}(1-x)$

(c)  $L(x) = -\frac{1}{e}(1+2x)$

(d)  $L(x) = 1 - \frac{1}{2e}x$

(e)  $L(x) = \frac{1}{e}(1+2x)$

23. Suppose  $f$  is continuous on  $[0, 4]$ ,  $f(0) = 1$  and  $2 \leq f'(x) \leq 5$  for all  $x$  in  $(0, 4)$ , then

(a)  $7 \leq f(4) \leq 19$

(b)  $3 \leq f(4) \leq 6$

(c)  $\frac{3}{2} \leq f(4) \leq \frac{9}{4}$

(d)  $9 \leq f(4) \leq 21$

(e)  $4 \leq f(4) \leq 11$

24. The equation of the **horizontal asymptote** to the graph of  $f(x) = 3x + \sqrt{9x^2 + 12x}$  is

(a)  $y = -\frac{1}{3}$

(b)  $y = -2$

(c)  $y = \frac{1}{6}$

(d)  $y = 0$

(e)  $y = -3$

25. If a box with a square base and open top must have a volume of  $4000 \text{ cm}^3$ , then the minimum surface area of such a box is

(a)  $1600 \text{ cm}^2$

(b)  $1800 \text{ cm}^2$

(c)  $800 \text{ cm}^2$

(d)  $1200 \text{ cm}^2$

(e)  $1400 \text{ cm}^2$

26. Let  $f(x) = \frac{1}{2} + \frac{3}{2}x$  and  $\epsilon = 0.006$ . The largest value of  $\delta$  such that  $|f(x) + 1| < \epsilon$  whenever  $|x + 1| < \delta$  is

(a) 0.004

(b) 0.003

(c) 0.005

(d) 0.002

(e) 0.001

27.  $\lim_{x \rightarrow 0^+} (1 + \sin 4x)^{\cot 3x} =$

(a)  $e^{3/4}$

(b) 1

(c)  $e^{4/3}$

(d)  $\infty$

(e)  $e^{12}$

28. If  $M$  and  $m$  are the absolute maximum and the absolute minimum, respectively, of the function  $f(x) = x\sqrt{4 - x^2}$  on  $[-1, 2]$ , then  $\sqrt{3}M + 4m =$

(a)  $\sqrt{3}$

(b) 3

(c)  $-3\sqrt{3}$

(d)  $-2\sqrt{3}$

(e) -3

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67	a	b	c	d	e	f
68	a	b	c	d	e	f
69	a	b	c	d	e	f
70	a	b	c	d	e	f



King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics

**CODE 004**

**Calculus I  
FINAL EXAM**

**CODE 004**

**Semester I, Term 081  
Monday February 02, 2009  
Net Time Allowed: 180 minutes**

Name: \_\_\_\_\_

ID: \_\_\_\_\_ Sec: \_\_\_\_\_.

**Check that this exam has 28 questions.**

**Important Instructions:**

1. All types of calculators, pagers or mobile phones are NOT allowed during the examination.
2. Use HB 2.5 pencils only.
3. Use a good eraser. DO NOT use the erasers attached to the pencil.
4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
7. When bubbling, make sure that the bubbled space is fully covered.
8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1.  $\lim_{x \rightarrow 0} \frac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

(a)  $-\frac{4}{3}$

(b)  $-\frac{5}{6}$

(c)  $-\frac{1}{6}$

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

(e)  $-\frac{3}{2}$

2. The slope of the tangent line to the graph of  $x \tan^{-1} y = \frac{\pi}{4} y$  at the point  $(1, 1)$  is

(a)  $\frac{3\pi}{\pi - 2}$

(b)  $\frac{\pi}{2}$

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

(d)  $\frac{\pi}{\pi - 2}$

(e) 1

3. Using differentials (or equivalently, a linear approximation), the value of  $\sqrt{0.17}$  is approximately equal to

(a)  $\frac{13}{40}$

(b)  $\frac{33}{80}$

(c)  $\frac{37}{80}$

(d)  $\frac{9}{20}$

(e)  $\frac{17}{40}$

4. If  $f(x) = \frac{1}{3(2-x)}$ , then  $f^{(4)}(-2) =$

(a)  $2^{-7}$

(b)  $2^{-10}$

(c)  $2^{-13}$

(d)  $2^{-3}$

(e)  $2^{-5}$

5. If  $f(x) = \tan\left(x + \frac{\pi}{2} \sin 2x\right)$ , then  $f'\left(\frac{\pi}{4}\right) =$

(a) 2

(b) 1

(c) 4

(d)  $\frac{3}{2}$

(e) 0

6. Using the first derivative test, the function  $f(x) = x^4(x - 1)^3$  has

(a) one local maximum and one local minimum

(b) one local maximum and no local minimum

(c) two local maxima and one local minimum

(d) one local minimum and no local maximum

(e) two local minima and one local maximum

7. The sum of all values of  $x$ ,  $0 \leq x \leq 3\pi$ , at which the graph of  $f(x) = \frac{\sin x}{2 - \cos x}$  has horizontal tangents, is

(a)  $3\pi$

(b)  $\frac{10\pi}{3}$

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

(d)  $\frac{16\pi}{3}$

(e)  $\frac{13\pi}{3}$

8. If  $f''(x) = 6x - 30\sqrt{x}$ ,  $f(0) = 1$  and  $f'(0) = 2$ , then  $f(1) =$

(a)  $-4$

(b)  $-2$

(c)  $6$

(d)  $8$

(e)  $-9$

9. If  $f(x) = \begin{cases} ax^2 + bx + 2, & x \leq 1/2 \\ 2ax - b, & x > 1/2 \end{cases}$  is a continuous function, then  $3a - 6b =$

(a)  $-1$

(b)  $-2$

(c)  $8$

(d)  $6$

(e)  $10$

10. If  $y = mx + c$  is the equation of the slant asymptote of the curve  $y = \frac{3x^4 + 2x + 1}{2x^3 + 8x^2}$ , then  $m + c =$

(a)  $-\frac{9}{2}$

(b)  $-\frac{3}{2}$

(c)  $3$

(d)  $-3$

(e)  $\frac{11}{2}$

11. A ladder 3 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of  $\frac{1}{4}$  ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is  $\sqrt{5}$  ft from the wall?
- (a)  $-\frac{\sqrt{5}}{2}$  ft/s
- (b)  $-2\sqrt{5}$  ft/s
- (c)  $-\frac{\sqrt{5}}{8}$  ft/s
- (d)  $2\sqrt{5}$  ft/s
- (e)  $\frac{\sqrt{5}}{2}$  ft/s
12. The graph of the function  $f(x) = \cos^2 x - 2 \sin x$ ,  $0 < x < 2\pi$ , is decreasing on
- (a)  $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$
- (b)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$
- (c)  $\left(\frac{\pi}{2}, \pi\right)$  and  $\left(\frac{3\pi}{2}, 2\pi\right)$
- (d)  $(\pi, 2\pi)$
- (e)  $\left(0, \frac{\pi}{2}\right)$  and  $\left(\pi, \frac{3\pi}{2}\right)$

13. If  $f(x) = x^{\ln x}$ , then  $f'(e) =$

(a)  $\frac{2}{e}$

(b)  $\frac{1}{e}$

(c) 1

(d) 0

(e) 2

14. The sum of all critical numbers of the function  $f(x) = (x^2 + 3x + 2)^{4/5}$  is

(a)  $-\frac{9}{2}$

(b)  $-\frac{7}{2}$

(c)  $-\frac{5}{2}$

(d) -3

(e)  $-\frac{3}{2}$



15. The asymptotes of the curve  $y = \frac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$  are
- (a) one horizontal and three vertical asymptotes
  - (b) one horizontal and one vertical asymptotes
  - (c) one slant and one vertical asymptotes
  - (d) one horizontal and two vertical asymptotes
  - (e) one horizontal, one slant, and one vertical asymptotes

16. The number of points of inflection of the curve  $f(x) = x^5 - 5x^4$  is
- (a) 1
  - (b) 2
  - (c) 3
  - (d) 0
  - (e) 4

17. If  $y = \ln\left(\frac{e^{-3}}{e^{2x} + e^{-2x}}\right)$ , then  $y' =$

(a)  $-3 - 2 \cosh(2x)$

(b)  $-3 \tanh(2x)$

(c)  $-3 + 2 \sinh(2x)$

(d)  $2 \sinh(2x)$

(e)  $-2 \tanh(2x)$

18. A particle moves on a straight line with acceleration given by  $a(t) = 10 \sin t + 3 \cos t$ . If  $v(t)$  is its velocity function such that  $v(0) = -6$  cm/sec., then  $v(\pi) =$

(a) 3 cm/sec.

(b)  $-3$  cm/sec.

(c) 13 cm/sec.

(d) 14 cm/sec.

(e)  $-7$  cm/sec.

19. The slope of the tangent line to the graph of  $y = \tanh^{-1} \sqrt{x}$  at  $x = \frac{1}{4}$  is

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

(b)  $\frac{3}{5}$

(c)  $\frac{4}{3}$

(d)  $\frac{2}{3}$

(e) 1

20. If  $f''(x) = \frac{-2}{x^{4/3}(9-x)^{5/3}}$ , then which one of the following statements is **TRUE** about the concavity of the curve  $y = f(x)$ ?

[ $CU \equiv$  concave upward,  $CD \equiv$  concave downward]

(a)  $CU$  on  $(-\infty, 0)$  and  $(0, 9)$ ; and  $CD$  on  $(9, \infty)$

(b)  $CU$  on  $(-\infty, 0)$ ; and  $CD$  on  $(0, 9)$  and  $(9, \infty)$

(c)  $CU$  on  $(0, 9)$  and  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$

(d)  $CU$  on  $(9, \infty)$ ; and  $CD$  on  $(-\infty, 0)$  and  $(0, 9)$

(e)  $CU$  on  $(-\infty, 0)$  and  $(9, \infty)$ ; and  $CD$  on  $(0, 9)$

21. The linearization  $L(x)$  of the function  $f(x) = e^{-\sqrt{2x+1}}$  at  $a = 0$  is given by

(a)  $L(x) = \frac{1}{e}(1 - x)$

(b)  $L(x) = 1 - \frac{1}{2e}x$

(c)  $L(x) = \frac{1}{e}(1 + 2x)$

(d)  $L(x) = -\frac{1}{e}(1 + 2x)$

(e)  $L(x) = \frac{1}{e}(2 - x)$

22. Newton's Method is used to find a root of the equation  $x^3 + 2x - 4 = 0$ . If the first approximation is  $x_1 = 1$ , then the second approximation is  $x_2 =$

(a) 1.20

(b) 1.40

(c) 1.45

(d) 1.35

(e) 1.25

23.  $\lim_{x \rightarrow 0^+} (1 + \sin 4x)^{\cot 3x} =$

(a)  $\infty$

(b) 1

(c)  $e^{4/3}$

(d)  $e^{12}$

(e)  $e^{3/4}$

24. If  $M$  and  $m$  are the absolute maximum and the absolute minimum, respectively, of the function  $f(x) = x\sqrt{4-x^2}$  on  $[-1, 2]$ , then  $\sqrt{3}M + 4m =$

(a)  $-2\sqrt{3}$

(b) 3

(c) -3

(d)  $\sqrt{3}$

(e)  $-3\sqrt{3}$

25. Suppose  $f$  is continuous on  $[0, 4]$ ,  $f(0) = 1$  and  $2 \leq f'(x) \leq 5$  for all  $x$  in  $(0, 4)$ , then

(a)  $7 \leq f(4) \leq 19$

(b)  $9 \leq f(4) \leq 21$

(c)  $\frac{3}{2} \leq f(4) \leq \frac{9}{4}$

(d)  $4 \leq f(4) \leq 11$

(e)  $3 \leq f(4) \leq 6$

26. Let  $f(x) = \frac{1}{2} + \frac{3}{2}x$  and  $\epsilon = 0.006$ . The largest value of  $\delta$  such that  $|f(x) + 1| < \epsilon$  whenever  $|x + 1| < \delta$  is

(a) 0.005

(b) 0.003

(c) 0.004

(d) 0.002

(e) 0.001

27. The equation of the **horizontal asymptote** to the graph of  $f(x) = 3x + \sqrt{9x^2 + 12x}$  is

(a)  $y = -\frac{1}{3}$

(b)  $y = -2$

(c)  $y = 0$

(d)  $y = \frac{1}{6}$

(e)  $y = -3$

28. If a box with a square base and open top must have a volume of  $4000 \text{ cm}^3$ , then the minimum surface area of such a box is

(a)  $800 \text{ cm}^2$

(b)  $1200 \text{ cm}^2$

(c)  $1600 \text{ cm}^2$

(d)  $1800 \text{ cm}^2$

(e)  $1400 \text{ cm}^2$

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70	a	b	c	d	e	f



Q	MM	V1	V2	V3	V4
1	a	d	c	d	a
2	a	a	a	a	d
3	a	c	b	d	b
4	a	c	e	d	a
5	a	e	c	c	a
6	a	e	a	b	a
7	a	e	b	c	e
8	a	e	c	b	a
9	a	b	e	d	c
10	a	e	b	e	a
11	a	a	b	b	c
12	a	a	e	b	b
13	a	b	e	a	e
14	a	e	d	a	a
15	a	b	b	c	b
16	a	a	a	c	a
17	a	b	a	b	e
18	a	d	d	c	d
19	a	a	d	a	c
20	a	d	b	d	d
21	a	e	b	d	a
22	a	b	a	b	a
23	a	a	a	d	c
24	a	c	e	b	a
25	a	a	b	d	b
26	a	c	e	a	c
27	a	e	e	c	b
28	a	d	a	d	b

## Answer Counts

V	a	b	c	d	e
1	5	5	6	7	5
2	8	4	6	5	5
3	7	4	6	6	5
4	6	9	3	5	5

VQ	MQ	Answers
1	15	e b d a c
2	8	a e c d b
3	3	d c a e b
4	1	e d a b c
5	7	e b c d a
6	12	c e d b a
7	18	d c e b a
8	6	c d b e a
9	22	d a b e c
10	21	c d e b a
11	5	a d e b c
12	14	a b d c e
13	4	d a c b e
14	16	b d e c a
15	10	e a b c d
16	13	a d e b c
17	11	d a b e c
18	9	c e b a d
19	20	a e c d b
20	19	e b c a d
21	17	b d e c a
22	2	b a e d c
23	24	a c e d b
24	23	b c a d e
25	27	a c b d e
26	26	c e a d b
27	28	c b e d a
28	25	e c d a b

VQ	MQ	Answers
1	12	e c a b d
2	15	a d e c b
3	17	d a c e b
4	3	d c e b a
5	10	b e a d c
6	21	a e b c d
7	5	e a c d b
8	13	e d a b c
9	7	d e b c a
10	8	b a d c e
11	14	d a c b e
12	1	e b d c a
13	16	d e c b a
14	11	b c e a d
15	22	c a b e d
16	6	a c b e d
17	4	a c d b e
18	9	b e d a c
19	19	e d c a b
20	20	d a b c e
21	2	c a d e b
22	18	a b c e d
23	26	a b c d e
24	23	e c d b a
25	28	b a d c e
26	24	c d e b a
27	25	e b d c a
28	27	a d c b e

VQ	MQ	Answers
1	9	b c e a d
2	11	a b c e d
3	5	e c b a d
4	17	b d e a c
5	20	c d a e b
6	10	b a d e c
7	8	d c a b e
8	14	e a c d b
9	7	e c b a d
10	15	e d c b a
11	3	c a e d b
12	16	e a c b d
13	1	a d c e b
14	19	a b e d c
15	21	b e a c d
16	22	d c a e b
17	12	d a e b c
18	18	c e a b d
19	6	a d c e b
20	2	b e c a d
21	4	d b e a c
22	13	d a c e b
23	27	b c d a e
24	26	c a d b e
25	23	d e b a c
26	28	a b c e d
27	25	b e a d c
28	24	b d c a e

VQ	MQ	Answers
1	7	a b d e c
2	18	e b d a c
3	12	e a b d c
4	4	a c d e b
5	19	a b d c e
6	9	a b d c e
7	20	b c d e a
8	1	a c b d e
9	8	d b a c e
10	22	a e b d c
11	14	c e a d b
12	10	b a d c e
13	16	b d c e a
14	3	a d c b e
15	5	b a d c e
16	17	a b c e d
17	15	c d e b a
18	6	e b c a d
19	11	d b a c e
20	21	c e d a b
21	13	a e b c d
22	2	a d c e b
23	25	d e a c b
24	24	a d e b c
25	27	b a d e c
26	28	c b a e d
27	26	c a b d e
28	23	b a d e c