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

CODE 001 | **Calculus I** | **CODE 001**

FINAL EXAM
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 $y = \ln\left(\dfrac{e^{-3}}{e^{2x} + e^{-2x}}\right)$, 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 $f(x) = \begin{cases} ax^2 + bx + 2\ , & x \le 1/2 \\ 2ax - b\ , & x > 1/2 \end{cases}$ 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. $\lim\limits_{x \to 0} \dfrac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

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

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

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

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

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

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

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

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

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

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

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

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 $y = \dfrac{3x^4 + 2x + 1}{2x^3 + 8x^2}$, then $m + c =$

(a) -3

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

(c) 3

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

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

10. If $f''(x) = \dfrac{-2}{x^{4/3}(9-x)^{5/3}}$, 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 $y = \dfrac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$ 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) $-\dfrac{\sqrt{5}}{8}$ ft/s

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

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

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

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

13. If $f(x) = \dfrac{1}{3(2-x)}$, 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) $\dfrac{2}{e}$

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

(c) 0

(d) 1

(e) 2

15. The graph of the function $f(x) = \cos^2 x - 2\sin x, \quad 0 < x < 2\pi$, 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 $x,\ 0 \le x \le 3\pi$, at which the graph of $f(x) = \dfrac{\sin x}{2 - \cos x}$ has horizontal tangents, is

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

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

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

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

(e) 3π

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

(a) 0

(b) 1

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

(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 cm^3, then the minimum surface area of such a box is

(a) 800 cm^2

(b) 1400 cm^2

(c) 1200 cm^2

(d) 1600 cm^2

(e) 1800 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 δ 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. $\lim_{x \to 0^+} (1 + \sin 4x)^{\cot 3x} =$

(a) 1

(b) e^{12}

(c) ∞

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

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

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