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 $y = \dfrac{2x^3 + 3x^2 - 2x}{x^3 + 3x^2 + 2x}$ 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. $\lim_{x \to 0} \dfrac{e^{-2x} - 1 + 2x - 2x^2}{x^3} =$

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

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

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

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

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

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 $f(x) = \cos^2 x - 2\sin x, \quad 0 < x < 2\pi$, 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 $x = \dfrac{1}{4}$ is

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

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

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

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

(e) 1

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

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

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

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

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

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

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 $y = \ln\left(\dfrac{e^{-3}}{e^{2x}+e^{-2x}}\right)$, 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) $\dfrac{2}{e}$

(c) 1

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

(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, $0 \le x \le 3\pi$, at which the graph of $f(x) = \frac{\sin x}{2 - \cos x}$ has horizontal tangents, is

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

(b) 3π

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

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

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

21. 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 $(9, \infty)$; 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 $y = \dfrac{3x^4 + 2x + 1}{2x^3 + 8x^2}$, then $m + c =$

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

(b) 3

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

(d) -3

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

23. 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) 1200 cm^2

(b) 800 cm^2

(c) 1400 cm^2

(d) 1600 cm^2

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

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

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

(c) e^{12}

(d) ∞

(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 δ 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

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