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

CODE 001	**Math 101**	CODE 001

Math 101
Final Exam
Term 082
Monday 22/6/2009
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. The graph of $f(x) = \dfrac{x^4 + x^2}{(x^2+9)(x+1)}$ has

(a) one slant asymptote and one vertical asymptote

(b) two slant asymptotes and two vertical asymptotes

(c) one horizontal asymptote and two vertical asymptotes

(d) one slant asymptote and three vertical asymptotes

(e) one horizontal, one vertical, and one slant asymptote

2. The function $f(x) = \dfrac{\ln(x-1)}{2-\sqrt{x}}$ is continuous on

(a) $(1, 4) \cup (4, +\infty)$

(b) $[0, +\infty)$

(c) $(\sqrt{2}, +\infty)$

(d) $(2, +\infty)$

(e) $(1, +\infty)$

3. Using Newton's Method to find a root of the equation

$$3x - \sin(2\pi x) = 1$$

starting with $x_1 = \dfrac{1}{2}$, we find that $x_2 =$

(a) $\dfrac{\pi + 1}{2\pi + 3}$

(b) $2\pi - 1$

(c) $\dfrac{1}{4\pi + 6}$

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

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

4. $\displaystyle\lim_{x \to 5^+} \frac{4 - x}{(x - 5)^3}$

(a) $\dfrac{4}{5}$

(b) -1

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

(d) $+\infty$

(e) $-\infty$

5. The number of the inflection points of the graph of $y = \frac{1}{56}x^8 - \frac{1}{30}x^6 + 80$ is

(a) 4

(b) 6

(c) 3

(d) 2

(e) 1

6. The slope of the tangent line to the curve $\cos(xy^2) = y^3 - x + \frac{\pi}{2} - 1$ at $\left(\frac{\pi}{2}, 1\right)$ is

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

(b) $\frac{1}{3}$

(c) 1

(d) 0

(e) -1

7. The sum of the critical numbers of the function $f(x) = \sqrt[3]{x^2 - x}$ is

(a) 1

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

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

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

(e) 2

8. **All values** of x where the tangent line to the graph of $y = \tan^2 x$ is horizontal are given by

(a) $n\pi,\ n$ is integer

(b) $\frac{2n-1}{2}\pi,\ n$ is integer

(c) $\frac{n}{2}\pi,\ n$ is integer

(d) $(2n-1)\pi,\ n$ is integer

(e) $\left(n + \frac{1}{2}\right)\pi,\ n$ is integer

9. If g is a differentiable function and $f(x) = [g(x^2)]^2$, then $f'(x) =$

(a) $2g'(x^2)$

(b) $4xg'(x^2)$

(c) $4xg(x^2)g'(x^2)$

(d) $4x^3g'(x^4)$

(e) $2g(x^2)$

10. If $f(t) = te^t \sin t$, then $f'(t) =$

(a) $e^t \cos t + t \sin t$

(b) $te^t \sin t - te^t \cos t$

(c) $e^t \cos t$

(d) $te^t \cos t + (t+1)e^t \sin t$

(e) $te^t \cos t + te^t \sin t$

11. An equation of the tangent line to the curve $y = x^{(2^x)}$ at the point $(1,1)$ is

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

(b) $y = 3x - 2$

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

(d) $y = 2x - 1$

(e) $y = x$

12. If $f''(x) = -3x^{-2},\ f'(3) = 2,\ f(1) = -1,$ then $f(e) =$

(a) $e - 3$

(b) $\frac{3}{e} + 1$

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

(d) 0

(e) $e + 1$

13. If $f(x) = e^{1-2x}$, then $f^{(n)}(x) =$

(a) $(-2)^n\, e^{1-2x}$

(b) e^{1-2x}

(c) $2^n\, e^{1-2x}$

(d) $(-1)^n\, e^{1-2x}$

(e) $(1-2x)^n\, e^{1-2x}$

14. Sand is being dumped from a truck at a rate of 0.5 ft^3/min to form a pile in the shape of a cone whose height is always equal to the diameter of its base. When the pile is 2 ft high, the height of the pile is increasing at a rate of [The volume of a cone is $V = \frac{1}{3}\pi r^2 h$]

(a) $\frac{1}{2\pi}$ ft/min

(b) $\frac{\pi}{2}$ ft/min

(c) $\frac{2}{\pi}$ ft/min

(d) 2π ft/min

(e) $\frac{1}{2}$ ft/min

15. If

$$f(x) = \begin{cases} x^2+1 & \text{if } x<1 \\ ax+b & \text{if } 1 \le x < 3 \\ 3-2x & \text{if } x \ge 3 \end{cases}$$

is continuous on $(-\infty, +\infty)$, then $f(2) =$

(a) 5

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

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

(d) 2

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

16. If $x^6 + y^6 = 1$, then $y'' =$

(a) $-\frac{5x^4}{y^{11}}$

(b) $-\frac{x^5}{y^5}$

(c) $\frac{10x^4}{y^{10}}$

(d) $\frac{x^6+1}{y^5}$

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

17. Let $f(x) = e^x + \sin x$. Using the linear approximation of f at $a = 0$, we find that $f(0.1) \approx$

(a) 1.2

(b) 1

(c) 2.2

(d) 2

(e) 1.5

18. Which one of the following statements is **TRUE**?

(a) if $f'(x) = g'(x)$ for all x, then $f(x) = g(x)$ for all x.

(b) If f is continuous at a, then f is differentiable at a.

(c) If $f(x) = \pi^4$, then $f'(x) = 4\pi^3$.

(d) if $f'(c) = 0$ and $f''(c) > 0$, then f has a local minimum at c.

(e) If f has an absolute minimum value at c, then $f'(c) = 0$.

19. If $\tanh x = -\dfrac{2}{3}$, then $\cosh x =$

(a) $\pm\dfrac{3}{\sqrt{5}}$

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

(c) $-\dfrac{1}{\sqrt{5}}$

(d) $\pm\dfrac{1}{\sqrt{5}}$

(e) $-\dfrac{3}{\sqrt{5}}$

20. If $G(x) = \dfrac{1+\sinh x}{1+\cosh x}$, then $G(0) + G'(0) =$

(a) 1/4

(b) 0

(c) 3/4

(d) 2

(e) 1

21. If the point (x, y) lying on the line $y + 3x = 3$ is **the closest** point to the origin, then $x + 2y =$

(a) $\frac{6}{5}$

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

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

(d) 2

(e) 3

22. The graph of $f(x) = \sqrt[3]{x}\,(2 - x)$

(a) is concave down on the interval $(-\infty, 0)$

(b) is concave up on the intervals $(-\infty, -1)$ and $(0, 1)$

(c) has one inflection point only

(d) has an inflection point at $x = 1$

(e) is concave up on the interval $(-1, 0)$

23. If an equation of the tangent line to the curve $y = e^x$ that is parallel to the line $x - 4y = 1$ is given by $y = ax + b$, then $4(b - a) =$

(a) $\ln 4$

(b) 1

(c) 0

(d) $1 + \ln 4$

(e) $2 - \ln 4$

24. $\lim_{x \to 0^+} (1 - \tan^{-1}(2x))^{1/x} =$

(a) e

(b) $-e$

(c) e^{-2}

(d) e^{-1}

(e) $\sqrt{e}$

25. The function $f(x) = xe^{2x}$

(a) is increasing on $(-1, +\infty)$

(b) is increasing on $\left(-\infty, -\frac{1}{2}\right)$

(c) has a local maximum at $x = -\frac{1}{2}$

(d) has a local minimum at $x = -1$

(e) is increasing on $\left(-\frac{1}{2}, +\infty\right)$

26. If M and m are respectively the absolute maximum and absolute minimum values of $f(x) = x + 2\cos x$ on $\left[0, \frac{\pi}{3}\right]$, then $3M - \sqrt{3}m =$

(a) $\pi + 3\sqrt{3}$

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

(c) $2\pi + \sqrt{3}$

(d) 2

(e) $\frac{\pi}{2} + \sqrt{3}$

27. The value(s) of c satisfying the conclusion of the Mean Value Theorem for $f(x) = \dfrac{x}{x+2}$ on $[1, 4]$ is(are)

(a) 4

(b) $-2 \pm 3\sqrt{2}$

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

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

(e) $1, 2$

28. $\displaystyle\lim_{x \to 0} \frac{\cos(mx) - \cos(nx)}{x^2} =$ (m and n are constants)

(a) does not exist

(b) 1

(c) $\dfrac{1}{2}(n^2 - m^2)$

(d) 0

(e) $n^2 + m^2$

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