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

CODE 004 | **Math 101** | CODE 004

Final Exam
Term 103
Wednesday, August 17, 2011
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 Newton's method to find a root for $3x - \sin(2\pi x) = 1$, and taking $x_1 = \frac{1}{2}$ as the first approximation, the second approximation x_2 is

(a) 0

(b) π

(c) $\frac{1+\pi}{3+2\pi}$

(d) 1

(e) $\frac{1-\pi}{3-2\pi}$

2. If $\cosh x = \frac{5}{3}$ and $x < 0$, then $3\sinh x + 5\tanh x$ is equal to

(a) 6

(b) -8

(c) 0

(d) 8

(e) -6

3. The absolute maximum of $f(x) = xe^{-\frac{x^2}{8}}$ over $[-1, 4]$ is

(a) $\frac{4}{\sqrt{e}}$

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

(c) $\frac{4}{\sqrt[8]{e}}$

(d) $2\sqrt{e}$

(e) $\frac{-1}{\sqrt[8]{e}}$

4. The equation of the normal line to the parabola $y = x^2 - 5x + 4$ that is parallel to the line $x - 3y = 5$ is given by

(a) $3y = 4 - x$

(b) $3y = 1 - x$

(c) $3y = x - 4$

(d) $y = x - 1$

(e) $3y = x - 1$

5. $f(x) = e^{\frac{1}{x}}$ has

(a) one critical number and one inflection point

(b) no critical number and no inflection point

(c) no critical number and one inflection point

(d) no critical number and two inflection points

(e) one crticial number and no inflection point

6. If $f(x) = \begin{cases} \ln(x-5), & 5 < x \leq 6 \\ [\![x]\!] + [\![-x]\!], & x > 6 \end{cases}$. Find $\lim_{x \to 6} f(x)$.

(a) -2

(b) -1

(c) 0

(d) 1

(e) Does not exist

7. $\lim_{x\to\infty} \dfrac{x^2+\cos x}{(x-1)^4} =$

(a) ∞

(b) 1

(c) -1

(d) 0

(e) $-\infty$

8. If $x^3+y^3=1$, then $y''=$

(a) $2xy^4$

(b) $\dfrac{x}{y^5}$

(c) $\dfrac{-x}{y^4}$

(d) $\dfrac{x}{y^4}$

(e) $\dfrac{-2x}{y^5}$

9. If $f(t) = -t^2 + 3t + 5$ is the position of an object at time t, where $f(t)$ is in feet and t in seconds, then the total distance travelled by the object over the time interval $[0, 3]$ is

(a) 3 ft

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

(c) 5 ft

(d) $\frac{9}{2}$ ft

(e) 0 ft

10. The slant asymptote of $f(x) = e^x + x + 1$ is

(a) $y = 2x + 1$

(b) $y = x$

(c) $y = -2x + 1$

(d) $y = x + 1$

(e) None of these

11. If $x^y = (2-y)^x$ then y' at $x = 1$ is equal to

(a) -2

(b) 2

(c) -1

(d) 4

(e) $\ln 2$

12. If the function $f(x) = \begin{cases} \dfrac{\cos x - 1}{3\tan^2 x} & x \neq 0 \\ a & x = 0 \end{cases}$ is continuous on $\left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right)$, then $a =$

(a) None of these

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

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

(d) 0

(e) $-\dfrac{1}{3}$

13. $\lim_{x \to 0} 5x(\csc x + \cot 2x) =$

(a) $\frac{15}{2}$

(b) 15

(c) 0

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

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

14. $\sin^{-1} x + \cos^{-1} x =$

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

(b) None of these

(c) 0

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

(e) 1

15. Given $f(x) = \frac{x^3}{3} - x, \quad x \in [-2, 2]$, then which one of the following statements is true about the graph of f?

(a) f has no inflection points

(b) f is concave upward from $(-2, 2)$

(c) f is decreasing on $(-2, 0)$

(d) f is concave downward on $(-2, 0)$

(e) f is increasing on $(0, 2)$

16. Using the graph of $y = e^x$, the maximum value of δ such that $|e^x - 1| < \frac{1}{2}$ whenever $|x - 0| < \delta$ is equal to

(a) $\ln 2$

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

(c) None of these

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

(e) $\ln 3$

17. If $h(2) = 5,\ h'(2) = -3$, then $\left.\dfrac{d}{dx}\left(\dfrac{h(x)}{2x+1}\right)\right|_{x=2}$ is

(a) 1

(b) 5

(c) -5

(d) -1

(e) 0

18. A particle moves in a straight line and has acceleration $a(t) = 2$. Its initial velocity $v(0) = -5$ cm/s and its initial displacement $s(0) = 9$ cm. The position function $s(t)$ is

(a) $s(t) = t^2 + 5t - 9$

(b) cannot be determined from the given data

(c) $s(t) = t^2 - 5t + 9$

(d) $s(t) = t^2 - 9t + 5$

(e) $s(t) = 2t - 5$

19. $\lim_{x\to\infty} \sqrt[x]{x} =$

(a) $-\infty$

(b) ∞

(c) 1

(d) e

(e) 0

20. A street light is mounted at the top of a 5-meter-tall pole. A man 2 m tall walks away from the pole with a speed of $\frac{3}{2}$ m/s along a straight path. How fast is the tip of his shadow moving when he is 10 m from the pole?

(a) $\frac{5}{3}$ m/s

(b) 1 m/s

(c) $\frac{5}{2}$ m/s

(d) 5 m/s

(e) $\frac{3}{2}$ m/s

21. Suppose that $3 \leq f'(x) \leq 5$ for all values of x. Then $a \leq f(8) - f(2) \leq b$ where $b - a$ is equal to

(a) 12

(b) 10

(c) 4

(d) 6

(e) 8

22. If $f'(x)$ is a continuous function and $f'(3) = 3$, then $\lim_{x \to 0} \dfrac{f(3+3x) - f(3-3x)}{x} =$

(a) -3

(b) 3

(c) Does not exist

(d) 18

(e) 0

23. The dimensions of the rectangle of largest area that can be inscribed in a circle of radius r are

(a) $2r$ and $2r$

(b) $\sqrt{2}\,r$ and $\dfrac{r}{\sqrt{2}}$

(c) $3r$ and r

(d) $\sqrt{2}\,r$ and $\sqrt{2}\,r$

(e) $\dfrac{r}{\sqrt{2}}$ and $\dfrac{r}{\sqrt{2}}$

24. A cylindrical can (without bases) is to be made from a rectangular plate. If we can change the length and the width of the plate so that length + width = 3, then the dimensions of the plate that has to be chosen to get a can with the largest volume is

(a) width $= \dfrac{1}{2}$, length $= \dfrac{5}{2}$

(b) width $= \dfrac{5}{4}$, length $= \dfrac{7}{4}$

(c) None of these

(d) width = length $= \dfrac{3}{2}$

(e) width = 2, length = 1

25. If $f(x) = \dfrac{x^4+1}{x^2+2}$, then $f(x)$ has

(a) $f(x)$ has two slant asymptotes

(b) $f(x)$ has only one slant asymptote

(c) $f(x)$ has only one horizontal asymptote

(d) $f(x)$ has only one vertical asymptote

(e) None of these

26. If $y = e^{cx}$ satisfies the equation $y'' + 5y' - 6y = 0$ then the sum of values that c may have is

(a) 3

(b) -5

(c) 0

(d) 6

(e) -6

27. If $f(x) = xe^{\sqrt{x}}$, then $\lim_{h\to 0} \dfrac{f(4+h)-f(4)}{h} =$

(a) e^2

(b) 0

(c) Does not exist

(d) $2e^2$

(e) $-e^2$

28. The linear approximation of $\tan x$ at $x = 0$ is

(a) $\dfrac{1}{1+x^2}$

(b) $x^2 - 1$

(c) x

(d) $x - 1$

(e) $2x$