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

Math 101
Final Exam
Term 132
Saturday 17/05/2014

EXAM COVER

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

This exam was prepared using mcqs
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Term 132
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Net Time Allowed: 180 minutes

MASTER VERSION

1. $\lim_{x\to 0} \cos\left(\dfrac{\pi\, x}{\sin x}\right) =$

(a) -1

(b) 1

(c) Does not exist

(d) 0

(e) π

2. The linear approximation of $\sqrt[4]{1-3x}$ at $x = 0$ is

(a) $L(x) = 1 - \dfrac{3}{4}\, x$

(b) $L(x) = 1 - 3x$

(c) $L(x) = 1 - 4x$

(d) $L(x) = 1 - \dfrac{4}{3}\, x$

(e) $L(x) = 1 - 12x$

3. If a ball is thrown vertically upward with a velocity of $160\,ft/sec$, then its height after t seconds is $s(t) = 160t - 16t^2$. What is the acceleration after 2 seconds.

(a) $-32\,ft/sec^2$

(b) $32\,ft/sec^2$

(c) $-64\,ft/sec^2$

(d) $64\,ft/sec^2$

(e) $16\,ft/sec^2$

4. If $f(x) = x^4 - x$ on $[-1, 1]$, find the value c that satisfies the **Mean Value Theorem**.

(a) 0

(b) 1

(c) 2

(d) $\frac{1}{4}$

(e) $-\frac{1}{4}$

5. $\sum_{k=1}^{6}(3-k^2) =$

(a) -73

(b) -50

(c) -43

(d) -30

(e) -53

6. An equation of the slant asymptote of the graph of $y = \dfrac{5x^4+x^2+x}{x^3-x^2+2}$ is given by

(a) $y-5x-5=0$

(b) $y-5x+3=0$

(c) $y-3x+5=0$

(d) $y-5x+2=0$

(e) $y-3x+2=0$

7. If $f(x) = \tan^{-1}(x-1)$, then $f''(1) =$

(a) 0

(b) 2

(c) -1

(d) -2

(e) 1

8. If $\dfrac{dy}{dx} = 1 + \cos x, y(0) = 4$. Then $y(\pi) =$

(a) $4 + \pi$

(b) $4 - \pi$

(c) π

(d) 2π

(e) $4 - 2\pi$

9. If $y = \dfrac{\sin 2x}{\cos x}$, then $y^{(10)}(0) =$

(a) 0

(b) 2

(c) 1

(d) -1

(e) -2

10. If M and m are the absolute maximum and absolute minimum values respectively of the function

$$f(x) = x^3 - 3x^2 + 1, \ -\frac{1}{2} \leq x \leq 4,$$

then $M - m =$

(a) 20

(b) 14

(c) 10

(d) 18

(e) 16

11. If $f(x) = e^{\frac{1}{x}}$, then which one of the following is **False** about the graph of $f(x)$.

(a) f is increasing on $(-\infty, 0)$ and $(0, \infty)$

(b) f has no critical number

(c) f has the horizontal asymptote $y = 1$

(d) f has the vertical asymptote $x = 0$

(e) f has no $y-$ intercept

12. $\lim\limits_{x \to 0^+} (1 + \sin 3x)^{\cot 5x} =$

(a) $e^{3/5}$

(b) $e^{5/3}$

(c) 1

(d) e^{15}

(e) 0

13. If $y = (e^x)^{e^x}$, then $\dfrac{dy}{dx}|_{x=\ln 2} =$

(a) $8 \ln 2 + 8$

(b) $2 \ln 2 + 2$

(c) $4 \ln 2 + 4$

(d) $3 \ln 2 + 3$

(e) $5 \ln 2 + 5$

14. $\lim\limits_{x \to 1} \left(\dfrac{x}{\ln x} - \dfrac{1}{x \ln x} \right) =$

(a) 2

(b) 0

(c) 1

(d) ∞

(e) 3

15. The slope of the tangent line to the graph of $y = (5-3x)^{-2/3} + \frac{1}{8}\left(\frac{2}{x}+1\right)^4$ at $x = 2$ is

(a) -4

(b) $-4/3$

(c) 5

(d) -5

(e) -3

16. Use finite approximation to estimate the area in the first quadrant under the graph of $f(x) = x^2$ between $x = 0$ and $x = 1$ by using an upper sum with four rectangles of equal width.

(a) $\frac{15}{32}$

(b) $\frac{4}{32}$

(c) $\frac{15}{4}$

(d) $\frac{4}{15}$

(e) 8

17. Let $f(u)$ be a differentiable function of u and $f'(5) = 5$. If $y = f(u), u = \sqrt{x^2+9}$, then $\dfrac{dy}{dx}$ at $x = 4$ is equal to

(a) 4

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

(c) $\dfrac{2}{5}$

(d) $\dfrac{8}{5}$

(e) 2

18. The number of critical points of $g(x) = \sqrt[3]{2x - x^2}$ is

(a) 3

(b) 1

(c) 0

(d) 2

(e) 4

19. If $y = \sqrt{\dfrac{1-\cos 3x}{1+\cos 3x}}$, then $(\sin 3x)\dfrac{dy}{dx} =$

(a) $3y$

(b) $\dfrac{2}{3}y$

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

(d) $\dfrac{1}{4}y$

(e) $4y$

20. Suppose that $f'(x) \leq 1$ for $1 \leq x \leq 4$. Then the largest possible value of $f(4) - f(1)$ is

(a) 3

(b) 4

(c) 5

(d) 6

(e) 8

21. Given that $f(x) = x^{2/3}(6-x)^{1/3}$, $f'(x) = \dfrac{4-x}{x^{1/3}(6-x)^{2/3}}$ and $f''(x) = \dfrac{-8}{x^{4/3}(6-x)^{5/3}}$, then which one of the following is **True** about the graph of $f(x)$.

(a) f is concave downward on $(-\infty, 0)$ and $(0, 6)$

(b) f has two inflection points

(c) f is increasing on $(-\infty, 0)$

(d) f is decreasing on $(0, 4)$

(e) f has no inflection points

22. Water runs into a Conical tank at the rate of $\dfrac{3\pi}{4}\, ft^3/min.$ The tank stands point down and has a height of $9ft$ and base radius $3ft$. How fast is the water level rising when the water is $3\sqrt{3}\, ft$ deep?
$\left[\text{volume of a cone} = \dfrac{1}{3}\,(\text{Area of base}) \times \text{height}\right]$

(a) 0.25 ft/min

(b) 1.25 ft/min

(c) 0.5 ft/min

(d) 0.75 ft/min

(e) 1.00 ft/min

23. If $\int f(x)\,dx = \ln|x+1| + \sin(\pi x) + C$ where C is a constant, then $f(0) =$

(a) $1 + \pi$

(b) 3

(c) 0

(d) $4 - \pi$

(e) $\pi + 3$

24. If $e^{3y} = x + y - 1$, then the value of $\dfrac{d^2y}{dx^2}$ at the point $(2, 0)$ is

(a) $-\dfrac{9}{8}$

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

(c) $-\dfrac{1}{4}$

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

(e) $-\dfrac{5}{8}$

25. If α and β are constants such that the function

$$f(x) = \begin{cases} \dfrac{\alpha(e^x - 1)^2}{x \sin x}, & -\dfrac{\pi}{2} \le x < 0 \\ \beta + x, & 0 \le x \le \dfrac{\pi}{2} \end{cases}$$

is continuous at $x = 0$, then $\alpha - \beta =$

(a) 0

(b) 1

(c) -1

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

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

26. Newton's Method is used to estimate the x-coordinate of the point where the curve of $y = x^3 + 2x$ crosses the horizontal line $y = 2$. If we start with $x_0 = 1$, then $x_1 =$

(a) 0.8

(b) 1.1

(c) 1.02

(d) 0.9

(e) 1.05

27. If $1200\,m^2$ of material is used to construct a rectangular box with a square base and an open top, then the largest possible volume of the box is

(a) $4000\,m^3$

(b) $3600\,m^3$

(c) $4400\,m^3$

(d) $3200\,m^3$

(e) $4800\,m^3$

28. If the function $f(x) = ax\,e^{bx^2}$ has the maximum value $f(2) = 1$ where a and b are real numbers, then $16ab =$

(a) $-\sqrt{e}$

(b) $\sqrt{2e}$

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

(d) $+\sqrt{8e}$

(e) e