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

Math 101
Exam II
Semester 101
Tuesday, December 7, 2010
Net Time Allowed: 120 minutes

"a" is the correct answer in all of the questions

MASTER VERSION

1. If $y = \dfrac{1}{\sec x + \tan x}$, then $\dfrac{dy}{dx} =$

(a) $\dfrac{-\sec x}{\sec x + \tan x}$

(b) $\dfrac{\tan x}{\sec x + \tan x}$

(c) $\dfrac{-2\sec x}{(\sec x + \tan x)^2}$

(d) $\dfrac{\tan x}{(\sec x + \tan x)^2}$

(e) $\dfrac{-2}{(\sec x + \tan x)^2}$

2. If the tangent line to the parabola $y = 2x^2 + 3x + 2$ at the point (α, β) is perpendicular to the line $x + 7y = 0$, then $\alpha - \beta =$

(a) -6

(b) 9

(c) -5

(d) $-3/7$

(e) 3

3. The point on the curve $y = [\ln(2x+5)]^2$ with horizontal tangent is

(a) $(-2, 0)$

(b) $\left(-\frac{5}{2}, 0\right)$

(c) $(1, 0)$

(d) $(-4, 0)$

(e) $(-3, 0)$

4. The equation of motion of a particle is $S(t) = \sqrt{t} + \frac{1}{\sqrt{t}} + 19$, where S is in meters and t in minutes, then the the acceleration when the velocity is 0, is

(a) $\frac{1}{2}\ m/\min^2$

(b) $-\frac{1}{4}\ m/\min^2$

(c) $\frac{2}{3}\ m/\min^2$

(d) $\frac{3}{2}\ m/\min^2$

(e) $-\frac{3}{4}\ m/\min^2$

5. If $f(x) = 2^{-(3x^2+x)}$, then $f'(1) =$

(a) $-\frac{7}{16}\ln 2$

(b) $\frac{1}{16}\ln 2$

(c) $\frac{1}{16}$

(d) $-\frac{3}{8}$

(e) $-\frac{1}{16}\ln 2$

6. If $f(x) = g(e^{2x})$ and $g'(4) = \frac{1}{2}$, then $f'(\ln 2) =$

(a) 4

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

(c) 1

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

(e) 8

7. If $y = x\sin^{-1}x + x\cos^{-1}x$, then $x\dfrac{dy}{dx} =$

(a) y

(b) 0

(c) xy

(d) x^2y

(e) $2x(1-x^2)^{-1/2}$

8. If $x^2 + 2xy - 3y^2 = 9$, then $\dfrac{dy}{dx} =$

(a) $(x+y)(3y-x)^{-1}$

(b) $(2x-y)(y-x)^{-1}$

(c) $(x+y)(6y-x)^{-1}$

(d) $2(x-3y)(3y-x)^{-1}$

(e) $2(x+y)(y-x)^{-1}$

9. The tangent line to the curve $y = 2x^{e/2} - e^{\sin(x^2-1)+1}$ at the point $(1, 2-e)$ is parallel to the line

(a) $ex + y = e$

(b) $ex + ey = 1$

(c) $x + ey = e$

(d) the x-axis

(e) the y-axis

10. If $y^3 - x^3 = 1$, then $y'' =$

(a) $2xy^{-5}$

(b) y^{-5}

(c) $3xy^{-3}$

(d) x^2y^{-5}

(e) $2x^2y^{-2}$

11. If the position function S of a particle is given by the equation

$$S(t) = 2t^3 - 18t^2 + 48t + 5$$

where t is measured in seconds and S in meters, then the particle is speeding up on the time interval(s)

(a) $(2, 3)$ and $(4, \infty)$

(b) $(0, 2)$ and $(3, 4)$

(c) $(0, 3)$ and $(4, \infty)$

(d) $(2, 4)$

(e) $(1, 3)$

12. Let $F(x) = \dfrac{[f(x)]^\pi}{[3 + f(x)]^e}$ where f is a positive differentiable function. If $f(0) = f'(0) = 1$, then $F'(0) =$
[Hint: You may use logarithmic differentiation]

(a) $\dfrac{4\pi - e}{4^{e+1}}$

(b) $\dfrac{4e + \pi}{4^e}$

(c) $\dfrac{4\pi - e}{4^{e-2}}$

(d) $\dfrac{4e - \pi}{4^{e+1}}$

(e) $\dfrac{3\pi + e}{4^{e+1}}$

13. If the point $\left(-\frac{\pi}{4}, k\right)$ lies on the tangent line to the curve $y = \tan^{-1}(2x)$ at $x = \frac{1}{2}$, then $k =$

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

(b) 1

(c) -1

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

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

14. If $f(x) = (1 + 2x)^{(1+3x)}$, then $f'(1) =$

(a) $27(9 \ln 3 + 8)$

(b) $27(\ln 3 + 4)$

(c) 108

(d) $3(3 \ln 3 + 8)$

(e) 54

15. The slope of the normal line to the graph of $f(x) = \dfrac{2e^x + 1}{\sqrt{x+1}}$ at the point $(0, 3)$ is

(a) -2

(b) e

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

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

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

16. If $\displaystyle\lim_{x \to 0} \frac{\alpha \sin 2x + \beta \tan 4x}{x \cos x + 5 \sin 3x} = \frac{1}{2}$, where α and β are constants, then $\alpha + 2\beta =$

(a) 4

(b) 12

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

(d) $\dfrac{15}{2}$

(e) 6

17. If -4 is the x-intercept of the tangent line T to the curve $y = \sqrt{x}$, then the y-intercept of T is

(a) 1

(b) -4

(c) -2

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

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

18. If $f(x) = \frac{1}{4}\left(\frac{x-2}{x+2}\right)$, then $f^{(55)}(-1) =$

(a) $55!$

(b) $\frac{-1}{4}(55!)$

(c) $\frac{1}{2}(55!)$

(d) $\frac{-1}{4}(56!)$

(e) $56!$

19. If $f(x) = |x+1| + 3|x-2|$, then the sum $f'(-2) + f'(1) + f'(4)$

(a) is equal to -2

(b) is equal to 4

(c) is equal to -1

(d) Does not exist since f is not differentiable anywhere

(e) Does not exist since f is discontinuous at -1 and 2

20. If the function $f(x) = \begin{cases} \dfrac{\alpha(1-\cos 4x)}{3x^2}, & x < 0 \\ 3x + \dfrac{4}{\beta}, & x \geq 0 \end{cases}$

is continuous everywhere, when α and β are constants, then $\alpha\beta =$

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

(b) -3

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

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

(e) $\frac{3}{4}$