King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 106
Final Exam
211
December 25, 2021

EXAM COVER

Number of versions: 4
Number of questions: 21
Number of Answers: 5

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Net Time Allowed: 150 Minutes

MASTER VERSION

1. $\lim_{t \to 1^-} \dfrac{t^3 + 1}{1 - t} =$

(a) ∞ (correct)

(b) $-\infty$

(c) 1

(d) 0

(e) 3

2. If the demand function for a manufacturer's product is $p = 80 - 0.02q$, then the marginal-revenue when $q = 100$ is

(a) 76 (correct)

(b) 78

(c) 74

(d) 72

(e) 70

3. If $f(x) = \dfrac{x^2+1}{e^{3x}}$ then $f'(1) =$

(a) $-\dfrac{4}{e^3}$ (correct)

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

(c) $4e^3$

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

(e) $-4e^3$

4. The slope of the tangent line to the curve $x^3 + xy + y^3 = -1$ at the point $(-1, 1)$ is

(a) -2 (correct)

(b) -1

(c) 0

(d) 1

(e) 2

5. If $f(x) = e^x(x+4)$ then f has the inflection point when $x =$

(a) -6 (correct)
(b) -4
(c) -5
(d) 0
(e) -1

6. If $y = x^x$ then $y' =$

(a) $x^x(\ln\, x + 1)$ (correct)
(b) $x^x \ln\, x$
(c) x^{x-1}
(d) x^x
(e) $x^{x-1} \ln\, x$

7. $\int_0^1 10x\sqrt{5x^2+4}\,dx =$

(a) $38/3$ (correct)

(b) $22/3$

(c) $32/3$

(d) $11/3$

(e) $53/2$

8. A manufacturer of a product has a marginal revenue function given by $\frac{dr}{dq} = 200 + 70q - 3q^2$. The demand function of the product is given by

(a) $200 + 35q - q^2$ (correct)

(b) $200q + 35q^2 - q^3$

(c) $200q + 35q^3 - q^4$

(d) $\frac{70}{q} - 6q$

(e) $70 - 6q$

9. $\displaystyle\int \frac{2x^4 - 8x^3 + 7x - 4}{x^3}\,dx =$

(a) $\dfrac{x^4 - 8x^3 - 7x + 2}{x^2} + C$ (correct)

(b) $\dfrac{x^4 + 8x^3 + 7x - 2}{x^2} + C$

(c) $\dfrac{2x^4 - 8x^3 - 7x + 4}{x^2} + C$

(d) $\dfrac{x^4 + 8x^3 - 7x - 4}{x^3} + C$

(e) $\dfrac{2x^4 - 8x^3 + 7x - 4}{x^3} + C$

10. $\displaystyle\int_0^5 \frac{x}{x^2 + 1}\,dx =$

(a) $\ln(\sqrt{26})$ (correct)

(b) $\ln(24)$

(c) $\dfrac{1}{2}\ln(24)$

(d) $\ln(26)$

(e) 5

11. $\int_0^2 2e^{\frac{x}{2}}\,dx =$

(a) $4(e-1)$ (correct)

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

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

(d) $2(e-1)$

(e) $e+1$

12. The total-cost function is given by $c = 0.05q^2 + 5q + 500$. Then the production level at which the average cost per unit be a minimum is

(a) 100 (correct)

(b) 200

(c) 10

(d) 300

(e) 400

13. The area enclosed by the parabola $y = x^2$ and the line $y = 2x + 3$ is equal to

(a) $\frac{32}{3}$ (correct)

(b) $\frac{17}{6}$

(c) $\frac{8}{3}$

(d) $\frac{35}{3}$

(e) $\frac{29}{3}$

14. $\int_1^2 xe^{2x}\,dx =$

(a) $\frac{1}{4}e^2(3e^2 - 1)$ (correct)

(b) $\frac{1}{4}e^2(2e^2 - 3)$

(c) $\frac{e^2}{4}$

(d) $\frac{1}{4}e^2(e^2 + 1)$

(e) e^4

15. $\int_1^e \ln x dx =$

(a) 1 (correct)
(b) $e-1$
(c) $3e+2$
(d) 0
(e) $1-e$

16. Use the formula

$$\int \frac{1}{\sqrt{u^2+a^2}}\,du = \ln|u+\sqrt{u^2+a^2}| + C$$

to find $\int \frac{dx}{\sqrt{9x^2+4}}$

(a) $\frac{1}{3}\ln|3x+\sqrt{9x^2+4}| + C$ (correct)
(b) $3\ln|3x+\sqrt{9x^2+4}| + C$
(c) $\ln|3x+\sqrt{9x^2+9}| + C$
(d) $\frac{1}{3}\ln|x+\sqrt{9x^2+4}| + C$
(e) $\ln|9x+\sqrt{9x^2+4}| + C$

17. If $z = y\sqrt{x^2+6y}$ then $\dfrac{\partial z}{\partial y} =$

(a) $\dfrac{x^2+9y}{\sqrt{x^2+6y}}$ (correct)

(b) $\sqrt{x^2+6y}$

(c) $(2x+6)y\sqrt{x^2+6y}$

(d) $\dfrac{3y}{\sqrt{x^2+6y}}$

(e) $\dfrac{x^2-9y}{\sqrt{x^2+6y}}$

18. If $f(x,y,z) = x^2yz^2 + xy^2z + xy$ then $f_x(1,2,3)$ is equal to

(a) 50 (correct)

(b) 48

(c) 36

(d) 55

(e) 32

19. The function $f(x,y) = x^2 + y^2 - xy + x^3$ has

(a) a relate minimum at $(0,0)$ and a saddle point at $\left(-\frac{1}{2}, -\frac{1}{4}\right)$ (correct)

(b) a relate maximum at $(0,0)$ and a relative minimum at $\left(-\frac{1}{2}, -\frac{1}{4}\right)$

(c) a saddle point at $(0,0)$ and a relative minimum at $\left(-\frac{1}{2}, -\frac{1}{4}\right)$

(d) a relate minimum at $(0,0)$ and a relative maximum at $\left(-\frac{1}{2}, -\frac{1}{4}\right)$

(e) a relate maximum at $(0,0)$ and a saddle point at $\left(-\frac{1}{2}, -\frac{1}{4}\right)$

20. $\displaystyle\int \frac{3x-4}{x^2-2x}\,dx =$

(a) $\ln x^2 + \ln|x-2| + C$ (correct)

(b) $\ln x^2 - 3\ln|x-2| + C$

(c) $\ln|x| - 2\ln|x-2| + C$

(d) $-\ln|x| + 2\ln|x-2| + C$

(e) $\ln|\sqrt{x}| - \ln|x-2| + C$

21. If $g(u, v, w) = (u^2 + 3v)^2(4w - 5)$ then $g_{uw}(-1, 1, 3)$ is equal to

(a) -64 (correct)

(b) -32

(c) 32

(d) 64

(e) 16