King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 106

Final Exam

221

December 31, 2022

Net Time Allowed: 180 Minutes

USE THIS AS A TEMPLATE

Write your questions, once you are satisfied upload this file.

1. $\lim_{x \to -4} \frac{x+4}{x^2-16} =$

   (a) $-\frac{1}{8}$
   (b) 0
   (c) ∞
   (d) $\frac{1}{4}$
   (e) $-\frac{1}{4}$

2. If a manufacturer's average-cost equation is

   $$\bar{c} = 0.002q^2 - 0.5q + 60 + \frac{7000}{q},$$

   find the marginal cost function when 25 units are produced?

   (a) 38.75
   (b) 37.75
   (c) 36.75
   (d) 35.75
   (e) 34.75

3. If $F(x) = \dfrac{4x^2+3}{2x-1}$, find $F'(x)$

(a) $\dfrac{8x^2-8x-6}{(2x-1)^2}$

(b) $\dfrac{8x^2+8x-6}{(4x^2+3)^2}$

(c) $\dfrac{8x^2+8x-6}{(4x^2-3)^2}$

(d) $\dfrac{8x^2-8x+6}{(2x-1)^2}$

(e) $\dfrac{8x^2+8x-6}{(2x-1)^2}$

4. If $z = 2y^2 - 4y + 5$, $y = 6x - 5$, and $x = 2t$, then $\dfrac{dz}{dt}$ when $t = 1$ is equal to

(a) 288

(b) 0

(c) 48

(d) 144

(e) 12

5. An equation of the tangent line to the curve $f(x) = x^2 e^x$ when $x = -2$ is

(a) $y = \dfrac{4}{e^2}$

(b) $y = \dfrac{8}{e^2}x + \dfrac{20}{e^2}$

(c) $y = -\dfrac{8}{e^2}x + \dfrac{20}{e^2}$

(d) $y = \dfrac{4}{e^2}x + \dfrac{8}{e^2}$

(e) $y = -\dfrac{4}{e^2}x + \dfrac{8}{e^2}$

6. If $f(x) = -x \ln x + 2x$, then f is

(a) increasing on $(0, e)$

(b) increasing on $(0, \infty)$

(c) increasing on (e, ∞)

(d) decreasing on $\left(\dfrac{1}{e}, \infty\right)$

(e) decreasing on $\left(0, \dfrac{1}{e}\right)$

7. For the cost function $c = q^3 + 2q - 1$, the average-cost function is

   (a) concave up on $(1, \infty)$
   (b) concave up on $(0, \infty)$
   (c) concave up on $(0, 2)$
   (d) concave up on $(0, 1)$
   (e) concave down on $(2, \infty)$

8. Identify the true statement. The graph of $f(x) = \dfrac{2x^2}{x^2 + x - 6}$ has

   (a) a horizontal asymptote $y = 2$
   (b) a vertical asymptote $x = 3$
   (c) horizontal asymptotes $x = 2$ and $x = -3$
   (d) no vertical asymptote
   (e) no horizontal asymptote

9. If the marginal revenue functions is $\frac{dr}{dq} = 275 - 2q - 0.3q^2$, then the demand function is

(a) $p = 275 - q - 0.1q^2$
(b) $p = 275q - q^2 - 0.1q^3$
(c) $p = \frac{275}{q} - 2 - 0.3q^2$
(d) $p = -2 - 0.6q$
(e) $p = \frac{275}{q} + 2 - 0.3q^2$

10. $\int x^2(3x^3 + 7)^3 \, dx =$

(a) $\frac{(3x^3 + 7)^4}{36} + c$
(b) $\frac{(9x^2 + 7)^4}{4} + c$
(c) $\frac{(3x^3 + 7)^4}{12} + c$
(d) $\frac{x^3(3x^3 + 7)^4}{12} + c$
(e) $\frac{x^3(3x^3 + 7)^4}{36} + c$

11. $\displaystyle\int \frac{2x}{x^2+5}\,dx =$

(a) $\ln(x^2+5)+c$

(b) $\ln|2x|+c$

(c) $\ln(x^2+5)-\ln|2x|+c$

(d) $\dfrac{x^3}{3}+5x+c$

(e) $\ln\left|\dfrac{2x}{x^2+5}\right|+c$

12. $\displaystyle\int \frac{(3x+2)(x-4)}{x-3}\,dx =$

(a) $\frac{3}{2}(x-3)^2+8(x-3)-11\ln|x-3|+c$

(b) $\frac{3}{2}(x-3)^2-8(x-3)-11\ln|x-3|+c$

(c) $\frac{3}{2}(x-3)^2+8(x-3)+5\ln|x-3|+c$

(d) $\frac{3}{2}(x-3)^2-8(x-3)+5\ln|x-3|+c$

(e) $\frac{3}{2}(x-3)^2+11\ln|x-3|+c$

13. $\int \frac{(\sqrt{x}+2)^2}{3\sqrt{x}}\,dx =$

(a) $\frac{2}{9}(\sqrt{x}+2)^3 + c$

(b) $\frac{2}{3}(\sqrt{x}+2)^3 + c$

(c) $\frac{1}{9}(\sqrt{x}+2)^3 + c$

(d) $\frac{1}{3}(\sqrt{x}+2)^3 + c$

(e) $\frac{2}{3}(\sqrt{x}+2)^3 + \frac{1}{9}(\sqrt{x}+2)^2 - \frac{1}{3}\sqrt{x} + c$

14. $\int_2^{e+1} \frac{1}{x-1}\,dx =$

(a) 1

(b) $\ln(e) - \ln(2)$

(c) $1 - \ln(e+2)$

(d) 0

(e) $\ln(e+1) - \ln(2)$

15. $\displaystyle\int_{-71}^{71} \frac{t}{\ln e^t}\, dt =$

(a) 142

(b) 0

(c) $7(t-7)$

(d) $\ln(1+2t)$

(e) $\ln(\ln(142))$

16. The area of the region bounded by the curves $y = 4x - x^2 + 8$ and $y = x^2 - 2x$ is equal to

(a) $\dfrac{125}{3}$

(b) $\dfrac{112}{3}$

(c) 0

(d) $\dfrac{13}{3}$

(e) $\dfrac{112}{125}$

17. $\displaystyle\int \frac{2x+7}{e^{3x}}\,dx =$

(a) $-\dfrac{6x+23}{9\,e^{3x}}+c$

(b) $\dfrac{6x+23}{9\,e^{3x}}+c$

(c) $-\dfrac{2x+7}{3\,e^{3x}}+c$

(d) $\dfrac{2x+7}{3\,e^{3x}}+c$

(e) $-\dfrac{x-7}{3\,e^{3x}}+c$

18. By using partial fractions the $\displaystyle\int \frac{5x-2}{x^2-x}\,dx =$

(a) $2\ln|x| + 3\ln|x-1| + c$

(b) $\ln|x| + \ln|x-1| + c$

(c) $5\ln|x| - \ln|x-1| + c$

(d) $-2\ln|x| + \ln|x-1| + c$

(e) $\ln|5x-2| + \ln|x^2-x| + c$

19. By using partial fractions the $\int \frac{6x^2+13x+6}{(x+2)(x+1)^2}\,dx =$

(a) $4\ln|x+2| + 2\ln|x+1| + \frac{1}{x+1} + c$

(b) $4\ln|x+2| + 3\ln|x+1| + c$

(c) $4\ln|x+2| - 2\ln|x+1| + \ln(x+1)^2 + c$

(d) $4\ln|x+1| - 2\ln|x+2| - \frac{1}{x+1} + c$

(e) $\ln|x+2| + 2\ln|x+1| + c$

20. Given $\int \frac{du}{u^2\sqrt{a^2-u^2}} = -\frac{\sqrt{a^2-u^2}}{a^2u} + c$, then $\int \frac{dx}{x^2\sqrt{2-3x^2}} =$

(a) $-\frac{1}{2}\frac{\sqrt{2-3x^2}}{x} + c$

(b) $-\frac{\sqrt{3}}{2}\frac{\sqrt{2-3x^2}}{x} + c$

(c) $-\frac{1}{2}\frac{\sqrt{2-x^2}}{x} + c$

(d) $-\frac{1}{2\sqrt{3}}\frac{\sqrt{2-x^2}}{x} + c$

(e) $-\frac{1}{\sqrt{3}}\sqrt{\frac{2-3x^2}{x}} + c$

21. Let $h(r,s,t,u) = rst^2u \ln(1+rstu)$ then $h_t(1,1,0,1) =$

(a) 0
(b) 2
(c) $\ln(2)$
(d) 1
(e) 3

22. If $f(x,y) = 7x^2 + 3y^2$, then $f_y(x,y)$ is equal to

(a) $6y$
(b) $14x$
(c) 0
(d) $3y$
(e) $14x + 6y$

23. If $f(x,y) = y^2e^x + \ln(xy)$, then $f_{xyy}(1,2)$ is equal to

(a) $2e$
(b) $4e$
(c) $4e+1$
(d) $4e^2$
(e) e

24. Let $f(x,y) = xy - \frac{1}{x} - \frac{1}{y}$. Then f has

(a) a relative minimum
(b) a relative maximum
(c) a relative minimum and a relative maximum
(d) two relative minimums
(e) two relative maximums

25. Let $f(x, y) = 18x + 20y - 2x^2 - 4y^2 - xy$. If f has a relative maximum at the point (c, d), then $c + d =$

(a) 6
(b) 5
(c) 4
(d) 3
(e) 7

26. If $xe^y + y = 13$, then by the implicit differentiation $\dfrac{dy}{dx} =$

(a) $\dfrac{-e^y}{1 + xe^y}$
(b) $\dfrac{e^y}{1 - xe^y}$
(c) $\dfrac{1 + xe^y}{e^y}$
(d) $\dfrac{e^y}{1 + xe^y}$
(e) $(x + e^y)\, e^y$

27. If $y = \tan(7x^2 - 8x + 2)$, then $\dfrac{dy}{dx} =$

(a) $(14x - 8)\sec^2(7x^2 - 8x + 2)$
(b) $\sec^2(7x^2 - 8x + 2)$
(c) $\cot^2(7x^2 - 8x + 2)$
(d) $(14x - 8)\csc^2(7x^2 - 8x + 2)$
(e) $(14x - 8)\tan(7x^2 - 8x + 2)$

28. If $f(x) = 3x^2 + 12x + 14$, then f has a relative maximum at

(a) no point in the domain of f
(b) 2
(c) -2
(d) 38
(e) 14