1. The critical point of $f(x,y) = xy - x + y$ is

   (a) $(-1,1)$ _____ (correct)
   (b) $(1,1)$
   (c) $(-1,-1)$
   (d) $(1,-1)$
   (e) $(-1,0)$

2. If $P\left(\frac{3}{2},\frac{2}{3}\right)$ is a critical point of $f(x,y) = \ln(xy) + 2x^2 - xy - 6x$. Using the second derivative test, the function f

   (a) has a saddle point at P _____ (correct)
   (b) has a relative maximum at P
   (c) has a relative minimum at P
   (d) has an absolute maximum at P
   (e) the test fails at P

3. If $f(x,y) = e^{xy}$, then $f_{xx} = \ldots$

(a) y^2e^{xy} _____(correct)

(b) ye^{xy}

(c) xe^{xy}

(d) x^2e^{xy}

(e) $(x+y)e^{xy}$

4. If $f(x,y) = x^2 + y^3 + xy^2$ then $f_x(1,2) = \ldots$

(a) 6 _____(correc↻)

(b) 4

(c) 5

(d) 7

(e) 8

5. Using the formula $\displaystyle\int \frac{du}{u^2\sqrt{a^2-u^2}} = -\frac{\sqrt{a^2-u^2}}{a^2u} + C$, then $\displaystyle\int \frac{dx}{x^2\sqrt{8-4x^2}} = \ldots$

(a) $\displaystyle -\frac{\sqrt{2-x^2}}{4x} + C$ (correct)

(b) $\displaystyle \frac{\sqrt{2-x^2}}{4x} + C$

(c) $\displaystyle -\frac{\sqrt{4-x^2}}{4x} + C$

(d) $\displaystyle \frac{\sqrt{4-x^2}}{4x} + C$

(e) $\displaystyle \frac{\sqrt{2-x^2}}{2x} + C$

6. If $y = \tan^2 x$, then $y' = \ldots$

(a) $2\tan x \sec^2 x$ (correct)

(b) $\tan x \sec x$

(c) $2\tan x$

(d) $\tan x$

(e) $\tan^2 x \sec^2 x$

7. $\int xe^{2x}\,dx =$

(a) $\frac{1}{2}e^{2x}\left(x-\frac{1}{2}\right)+C$ (correct)

(b) $e^{2x}\left(x-\frac{1}{2}\right)+C$

(c) $\frac{1}{2}xe^{2x}+C$

(d) $e^{2x}\left(x+\frac{1}{2}\right)+C$

(e) $\frac{1}{2}e^{2x}\left(x+\frac{1}{2}\right)+C$

8. $\int \sqrt{\sin x}\,\cos x\,dx$

(a) $\frac{2}{3}\sin^{\frac{3}{2}} x+C$ (correct)

(b) $\sin^{\frac{3}{2}} x+C$

(c) $\frac{3}{2}\sin^{\frac{3}{2}} x+C$

(d) $\frac{-2}{3}\cos^{\frac{3}{2}} x+C$

(e) $\frac{-2}{3}\sin^{\frac{3}{2}} x+C$

9. $\int \frac{x^3 - 5}{x}\, dx =$

(a) $\frac{x^3}{3} - 5\ln|x| + C$ (correct)

(b) $\frac{x^4}{4} - 5x + C$

(c) $\frac{x^3}{3} - 5x^2 + C$

(d) $\frac{x^3}{3} - \ln|x| + C$

(e) $\frac{x^4}{4} - 5\ln|x| + C$

10. If the marginal revenue of manufacturing a product is $\frac{dr}{dq} = 2000 - 20q - 3q^2$. Then the demand function is given by

(a) $p = 2000 - 10q - q^2$ (correct)

(b) $p = 1000 - 20q - q^2$

(c) $p = 500 - 10q - q^2$

(d) $p = 2000 - 5q - q^2$

(e) $p = 2000 - 10q - 2q^2$

11. $\int (x^2+1)e^{x^3+3x}\,dx = \ldots$

(a) $\frac{1}{3}e^{x^3+3x}+C$ (correct)

(b) $\frac{1}{2}e^{x^3+3x}+C$

(c) $3e^{x^3+3x}+C$

(d) $xe^{x^3+3x}+C$

(e) $(x+1)e^{x^3+3x}+C$

12. $\int \frac{1}{\sqrt{x}(\sqrt{x}-3)^3}\,dx = \ldots$

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

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

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

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

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

13. $\int \frac{x^2}{x+1}\,dx = \ldots$

(a) $\frac{x^2}{2} - x + \ln|x+1| + C$ (correct)

(b) $x^2 - x + \ln|x+1| + C$

(c) $\frac{x^2}{2} + x + \ln|x+1| + C$

(d) $\frac{x^2}{2} - x + \ln|x-1| + C$

(e) $\frac{x^2}{2} - x - \ln|x-1| + C$

14. $\int \frac{\ln x}{x}\,dx = \ldots$

(a) $\frac{1}{2}(\ln x)^2 + C$ (correct)

(b) $(\ln x)^2 + C$

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

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

(e) $\frac{1}{2}\ln x^2 + C$

15. $\int_0^1 \sqrt[3]{x^4}\,dx = \ldots$

(a) $\frac{3}{7}$ (correct)

(b) $\frac{7}{3}$

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

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

(e) 0

16. The area between the curves of $f(x) = x^2 - 3$ and $g(x) = 2x$ is given by

(a) $\int_{-1}^{3} (3 + 2x - x^2)\,dx$ (correct)

(b) $\int_{1}^{3} (3 + 2x - x^2)\,dx$

(c) $\int_{-1}^{0} (3 + 2x - x^2)\,dx$

(d) $\int_{-1}^{3} (3 - 2x - x^2)\,dx$

(e) $\int_{-1}^{3} (x^2 - 2x - 3)\,dx$

17. $\lim_{x \to -2} \dfrac{x^2 - 4}{x^4 - 16} = \ldots$

(a) $\dfrac{1}{8}$ (correct)

(b) 0

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

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

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

18. Let $f(x) = \begin{cases} x^2 + a, & x < 1 \\ 2x + 3a, & x \geq 1 \end{cases}$ be a continuous function.
Then $a = \ldots$

(a) $\dfrac{-1}{2}$ (correct)

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

(c) 0

(d) 1

(e) -1

19. If $f(x) = (x^2+1)^{x+1}$, then $f'(-1) = \ldots$

(a) $\ln 2$ (correct)

(b) $2\ln 2$

(c) 1

(d) 0

(e) $3\ln 2$

20. The equation of the tangent line to the curve of $y = \dfrac{\sqrt{x}+1}{x}$ at $x = 1$ is given by

(a) $2y = -3x + 7$ (correct)

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

(c) $2y = -x - 7$

(d) $2y = -3x + 8$

(e) $y = -x + 3$

21. Let $C = \dfrac{5q^2}{q^2+1} + 500$ be the total cost where q is the number of units and C in dollars. The marginal cost when 3 units are produced is

(a) 0.3 (correct)
(b) 3
(c) 0.6
(d) 0.9
(e) 6

22. Let $f(x) = e^{-\frac{1}{2}x^2+1}$, then f is concave down on

(a) $(-1, 1)$ (correct)
(b) $(0, \infty)$
(c) $(-\infty, -1)$
(d) $(-\infty, -1) \cup (1, \infty)$
(e) $(1, \infty)$

23. Let $f(x) = 3x^5 - 5x^3$. The relative maximum value of $f(x)$ is equal to

(a) 2 _____(correct)

(b) 1

(c) -2

(d) 4

(e) 0

24. Using differentials, $\sqrt{98} \approx$

(a) 9.9 _____(correct)

(b) 9.8

(c) 9.7

(d) 10.1

(e) 9.6

Math 106, 223, Final Exam

Answer KEY

Q	MASTER	VERSION01	VERSION02	VERSION03	VERSION04
1	A	B 10	A 18	D 18	A 6
2	A	A 16	C 10	A 4	E 24
3	A	D 6	D 5	A 7	C 11
4	A	A 22	C 1	E 16	E 1
5	A	A 17	C 15	E 17	D 15
6	A	E 15	E 2	B 22	D 14
7	A	C 5	D 19	C 11	A 10
8	A	D 11	C 12	A 1	D 21
9	A	B 19	E 3	D 3	B 16
10	A	D 13	E 11	A 2	E 19
11	A	D 9	C 8	B 21	A 22
12	A	E 23	E 16	B 20	E 8
13	A	A 4	B 23	B 8	D 20
14	A	E 7	B 17	A 5	A 13
15	A	B 20	C 14	E 12	C 12
16	A	D 8	D 9	D 24	A 4
17	A	C 12	C 7	B 9	A 7
18	A	A 14	C 21	E 19	A 5
19	A	D 24	D 6	E 23	D 3
20	A	E 2	B 22	E 15	B 18
21	A	C 21	B 4	E 10	D 23
22	A	B 18	C 24	C 13	B 9
23	A	D 3	E 20	A 6	B 17
24	A	C 1	B 13	B 14	A 2

Answer Counts

V	A	B	C	D	E
1	5	4	4	7	4
2	1	5	9	4	5
3	6	6	2	3	7
4	8	4	2	6	4