1. [Q20 Sec. 11.5]
The line through the point $(-4, 5, 2)$ and perpendicular to the plane given by $-x + 2y + z = 5$ also passes through the point $(-3, a, b)$. Then $a + b =$

(a) 4 (correct)
(b) 7
(c) 12
(d) 11
(e) 10

2. [Q53 Sec. 11.5]
The plane $ax + by + cz = 21$ contains the points $(4, 1, 3)$ and $(2, -2, 1)$ and is perpendicular to the plane $x + 2y - z = 2$. Then $a + b + c =$

(a) 2 (correct)
(b) 3
(c) 4
(d) 5
(e) 7

3. [Q97 Sec. 11.5]
The distance between the point $(-2, 1, 3)$ and the line given by

$$x = 1 - t, \quad y = 2 + t, \quad z = -2t$$

is equal to

(a) $\dfrac{7}{\sqrt{3}}$ (correct)

(b) $\dfrac{5}{\sqrt{3}}$

(c) $\dfrac{1}{\sqrt{3}}$

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

(e) $\sqrt{3}$

4. [Project b. Sec. 11.5]
The distance between the skew lines

$L_1 : \ x = 2t, \ y = 4t, \ z = 6t$ and $L_2 : \ x = 1-s, \ y = 4+s, \ z = -1+s$

is equal to

(a) $\dfrac{20}{\sqrt{26}}$ (correct)

(b) $\dfrac{10}{\sqrt{13}}$

(c) $\dfrac{5\sqrt{26}}{13}$

(d) $2\sqrt{13}$

(e) $\sqrt{26}$

5. [∼ Example 4 Sec. 11.6]
The graph of the equation

$$2x^2 + 4y^2 + 2z^2 - 8x + 8y - 4z = c$$

is an ellipsoid when $c =$

(a) -11 (correct)
(b) -15
(c) -17
(d) -19
(e) -21

6. [∼ Q15. Sec. 13.4]
Using differentials, the quantity

$$(2.01)^2(6.01) - 2^2.6 =$$

is approximately equal to

(a) 0.28 (correct)
(b) 0.26
(c) 0.24
(d) 0.30
(e) 0.14

7. [Q38. Sec. 13.5]
Let $w = \sqrt{x-y} + \sqrt{y-z}$. The value of $\dfrac{\partial w}{\partial x} + \dfrac{\partial w}{\partial y} + \dfrac{\partial w}{\partial z}$ at $x = 5$, $y = 3$ and $z = 1$ is

(a) 0 (correct)

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

(c) $\sqrt{2}$

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

(e) $-4\sqrt{2}$

8. [Q29. Sec. 13.1]
Let D be the domain and R be the range of $f(x, y) = \arccos(x - y)$. Then

(a) $D = \{(x, y) : -1 + x \le y \le 1 + x\}$ and $R = [0, \pi]$ (correct)

(b) $D = \{(x, y) : -1 - x \le y \le 1 + x\}$ and $R = [0, \pi]$

(c) $D = \{(x, y) : -x \le y \le 1 - x\}$ and $R = [-\pi/2, \pi/2]$

(d) $D = \{(x, y) : -\dfrac{\pi}{2} \le x - y \le \dfrac{\pi}{2}\}$ and $R = [0, \infty)$

(e) $D = \{(x, y) : -\infty < x < \infty \text{ and } -\infty < y < \infty\}$ and $R = [-1, 1]$

9. [Q75. Sec. 13.1]
The level surfaces of the function $f(x, y, z) = 4x^2 + 4y^2 - z^2$ are

(a) hyperboloids of one sheet, hyperboloids of two sheets, and cones (correct)
(b) ellipsoids
(c) cones only
(d) hyperboloids of one sheet only
(e) elliptic paraboloids

10. [∼Q44. Sec. 13.5]
Let $w = f(x, y)$ with $x = g(s, t)$ and $y = h(s, t)$, where f, g, and h are differentiable functions, with the following values:

$g(1,2)$	$h(1,2)$	$g_s(1,2)$	$h_s(1,2)$	$f_x(4,3)$	$f_y(4,3)$
4	3	-3	5	-4	6

Then $w_s(1,2) =$

(a) 42 (correct)
(b) -39
(c) -38
(d) 36
(e) 20

11. [∼Q30. Sec. 13.2]

$$\lim_{(x,y)\to(1,1)} \frac{2x-y-1}{\sqrt{2x-y}-1} =$$

(a) 2 (correct)

(b) 0

(c) -2

(d) DNE

(e) 1

12. [Q84. Sec. 13.2]

Let

$$f(x,y) = |xy|\left(\frac{x^2-y^2}{x^2+y^2}\right).$$

The value of $f(0,0)$ such that f is continuous at the origin is

(a) 0 (correct)

(b) 1

(c) -1

(d) 2

(e) -2

13. [Q34. Sec. 13.5]

If $x \ln y + y^2 z + z^2 = 8$, then $\dfrac{\partial z}{\partial x} =$

(a) $\dfrac{-\ln y}{y^2 + 2z}$ (correct)

(b) $-\dfrac{x \ln y}{y + 2z}$

(c) $\dfrac{x}{y^2 + 2z}$

(d) $-\dfrac{y^2 z + z^2}{y^2 + 2z}$

(e) $-\dfrac{x \ln y}{y^2 + z^2 - 8}$

14. [Q98. Sec. 13.3]

If $z = \arctan\left(\dfrac{y}{x}\right)$, then

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} =$$

(a) 0 (correct)

(b) $-\dfrac{x + y}{(x^2 + y^2)^2}$

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

(d) $\dfrac{2xy}{(x^2 + y^2)^2}$

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

15. [Q21. Sec. 13.5]
If $w = ze^{xy}$, $x = s - t$, $y = s + t$, $z = st$, then $w_s =$

(a) $t(1 + 2s^2)e^{s^2-t^2}$ (correct)

(b) $(1 + s^2)e^{s^2-t^2}$

(c) $t(1 - s^2)e^{s^2-t^2}$

(d) $2ste^{s^2-t^2}$

(e) $e^{s^2-t^2}$