

**Answer Key: DCAC DADB ECBB**

1. Find all values of  $x$  so that the vectors  $\mathbf{a} = (x, -3, 1)$ ,  $\mathbf{b} = (x, x, 2)$  are perpendicular. The correct values of  $x$  are
- A. 0, 1  
B. -1, 2  
C. 1, 1  
D. 1, 2  
E. 2, 2
2. Determine  $a$  so that the line
- $$\frac{x-3}{7} = \frac{y+5}{a} = \frac{z+1}{4}$$
- is parallel to the plane  $2x + 3y - 5z = 10$ . The correct choice of  $a$  is
- A. 1  
B. 3  
C. 2  
D. -2  
E. -1
3. Determine  $a$  so that the lines  $x = a + t$ ,  $y = -3 + 2t$ ,  $z = t$  and  $x = 1 + s$ ,  $y = 2 - s$ ,  $z = 2s$  intersect. The correct choice of  $a$  is
- A. 0  
B. 1  
C. -1  
D. 2  
E. -2

4. The equation of the plane perpendicular to the line

$$\frac{x-1}{-2} = \frac{y-1}{3} = z$$

and containing the point  $(1, 1, 1)$  is

- A.  $x + y - z = 1$
- B.  $2x - 3y + z = 0$
- C.  $-2x + 3y + z = 2$
- D.  $2x + 3y - z = 4$
- E.  $3x - 2y + z = 2$

5. The surface whose equation in spherical coordinates is  $\phi = \pi$  represents

- A. a plane
- B. a cone with axis the  $z$ -axis
- C. the  $xy$  plane
- D. the negative  $z$  axis
- E. the  $z$  axis

6. Let  $L$  be the line tangent to the curve  $\mathbf{r}(t) = (\ln t, 2\sqrt{t}, t^2)$  at  $(0, 2, 1)$ . Then when  $L$  passes through the point  $(3, y, z)$ , we have

- A.  $y = 5$  and  $z = 7$
- B.  $y = 3$  and  $z = 3$
- C.  $y = 7$  and  $z = 5$
- D.  $y = 3$  and  $z = 6$
- E.  $y = 4$  and  $z = 5$

7. The curve  $\mathbf{r}(t) = (e^{2t}, -e^t)$ ,  $-\infty < t < \infty$ , has a graph most like

8. Let a particle move on the curve  $\mathbf{r}(t) = 5t\mathbf{i} + (1 - 3t)\mathbf{j} + (5 + 4t)\mathbf{k}$ , starting when  $t = 0$ . After it has gone a distance 2, the  $x$  coordinate is

A. 10

B.  $\sqrt{2}$

C.  $5\sqrt{2}$

D. 1/10

E.  $5/\sqrt{2}$

9. Let  $u = e^{2x} \sin(xy)$ . Then  $u_{xy} =$
- A.  $e^{2x} \left( (x + 1) \cos(xy) - xy \sin(xy) \right)$
  - B.  $e^{2x} \left( (x + 1) \cos(xy) + xy \sin(xy) \right)$
  - C.  $e^{2x} \left( -(x + 1) \cos(xy) - xy \sin(xy) \right)$
  - D.  $e^{2x} \left( (2x + 1) \cos(xy) + xy \sin(xy) \right)$
  - E.  $e^{2x} \left( (2x + 1) \cos(xy) - xy \sin(xy) \right)$
10. Let  $\Pi$  be the tangent plane to the paraboloid  $z = x^2 + 2y^2 + 6$  at the point  $(1, 1, 9)$ . Then  $\Pi$  intersects the  $z$ -axis when
- A.  $z = 1$
  - B.  $z = 2$
  - C.  $z = 3$
  - D.  $z = 4$
  - E.  $z = 5$

11. The level curve  $f(x, y) = 2$  of the function  $f(x, y) = x^2 - y^2 + 8x - 7$  is

- A. a parabola
- B. a hyperbola
- C. two lines
- D. an ellipse but not a circle
- E. a circle

12. The trajectory of a moving particle is given by

$$\mathbf{r}(t) = \left( t^2/2 - t, \cos(t - 1), \ln(1 + t) - t/2 \right).$$

When the speed is zero, the acceleration  $\mathbf{a}$  is

- A.  $(0, 0, 0)$
- B.  $(1, -1, -\frac{1}{4})$
- C.  $(1, -1, \frac{1}{4})$
- D.  $(1, 1, -\frac{1}{4})$
- E.  $(1, 1, \frac{1}{4})$