1. The area of the triangle with vertices $(2,0,0)$, $(0,4,0)$, $(0,0,6)$ is

A. 12

B. 14

C. 16

D. 18

E. 20

2. The plane passing through the point $(0,0,1)$ and parallel to the plane $x-y+2z=10$ intersects the y-axis at the point:

A. $(0,-1,0)$

B. $(0,1,0)$

C. $(0,-2,0)$

D. $(0,2,0)$

E. $(0,-3,0)$

3. The surface whose equation in spherical coordinates is $\rho + 4\sin\phi\sin\theta = 0$ represents

A. a cylinder

B. a sphere

C. a hyperbolic paraboloid

D. a cone

E. an elliptic paraboloid

4. The curve with vector equation

$$\vec{r}(t) = < 1 + t^3, 1 - t^3, 1 >$$

is:

A. a line

B. a parabola

C. a hyperbola

D. a circle

E. a circular helix

5. The unit tangent vector to the curve $\vec{r}(t) = t\vec{i} + 3t^2\vec{j} + (4\sin t)\vec{k}$ at $t = \pi/3$ is:

A. $(\vec{i} + 2\pi\vec{j} + 2\vec{k})$

B. $(\vec{i} + 2\pi\vec{j} + 2\vec{k})/\sqrt{5 + 4\pi^2}$

C. $(\vec{i} + \pi\vec{j} + 2\sqrt{3}\vec{k})$

D. $(\vec{i}+\pi\vec{j}+2\sqrt{3}\vec{k})/\sqrt{13 + \pi^2}$

E. $(\pi\vec{j} + \vec{k})/\sqrt{1 + \pi^2}$

6. Which of the following integrals gives the arclength of the curve $\vec{r}(t) =< t, \ln t, \frac{t^2}{4} >$ for $1 \leq t \leq 4$?

A. $\int_1^4 (1 + \frac{1}{t^3} + \frac{t^2}{4})\, dt$

B. $\int_1^4 (t + \frac{1}{t})\, dt$

C. $\int_1^4 (\frac{t}{2} + \frac{1}{t})\, dt$

D. $\int_1^4 \sqrt{\frac{t^4}{4} + \frac{1}{t^2} + \frac{t^6}{144}}\, dt$

E. $\int_1^4 \sqrt{t^2 + (\ln t)^2 + \frac{t^4}{16}}\, dt$

7. A particle travels along a curve with position $\vec{r} = \vec{r}(t)$. If the velocity of the particle at time t is $\vec{v}(t) = 3t^2\vec{i} + e^t\vec{k}$ and if $\vec{r}(0) = \vec{j} + \vec{k}$, what is $\vec{r}(2)$?

A. $12\vec{i} + e^2\vec{k}$

B. $2\vec{j} + 2\vec{k}$

C. $8\vec{i} + \vec{j} + 2\vec{k}$

D. $8\vec{i} + \vec{j} + e^2\vec{k}$

E. $2e^2\vec{j} + 2e^2\vec{k}$

8. The level curves of $f(x, y) = x^2 - 2x + 4y^2$ include:

A. ellipses

B. hyperbolas

C. parabolas

D. two lines

E. both B) and D)

9. If $u(x,y) = ye^{xy^2}$, then u_{xy} equals

A. $ye^{xy^2}(2+3xy^2)$

B. $y^2e^{xy^2}(2+3xy)$

C. $ye^{xy^2}(3+2xy^2)$

D. $y^2e^{xy^2}(3+2xy)$

E. $y^2e^{xy^2}(3+2xy^2)$

10. Find the linearization $L(x,y)$ of $u(x,y) = \dfrac{1}{x+2y}$ at the point $(2,1)$.

A. $z = \dfrac{1}{2} - \dfrac{x}{16} - \dfrac{y}{8}$

B. $z = 1 - \dfrac{x}{8} - \dfrac{y}{4}$

C. $z = \dfrac{1}{2} + \dfrac{x}{16} + \dfrac{y}{8}$

D. $z = \dfrac{1}{2} - \dfrac{x}{16} + \dfrac{y}{8}$

E. $z = \dfrac{1}{2} + \dfrac{x}{16} - \dfrac{y}{8}$

11. If $u(x,y,z) = x^2 - yz + yx$, $x = e^s \ln t$, $y = s + 2t$, $z = st$, find $\dfrac{\partial u}{\partial s}$ at $s = 0, t = 1$.

A. 0

B. -1

C. 2

D. 1

E. -2

12. Find the directional derivative of $f(x,y) = \dfrac{x}{y}$ at $P(2,1)$ in the direction of $\vec{v} =< 1, 1 >$.

A. 1

B. -1

C. $\dfrac{\sqrt{2}}{2}$

D. $-\dfrac{\sqrt{2}}{2}$

E. none of these