213

1)For the two intersecting lines $x - 2 = \frac{1}{2}(y + 1) = \frac{1}{3}(z - 3)$

and $\frac{1}{3}(x - 5) = \frac{1}{2}(y - 1) = z - 4$

a)Determine the coordinates of the point where they intersect

b)Determine the cosine of the angle between these two lines

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2)a)Determine the equation of the plane formed by the two parallel lines
$x = 1 + 2t, y = -t, z = -1 + t$ and $x = -4t, y = 1 + 2t, z = 2 - 2t$

b)Determine the shortest distance between these two parallel lines

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3)For the surface $x^2 = y^2 + z^2$

a)Sketch and identify this surface

b)Write this equation in spherical coordinates

c)Show the location of the point, given in spherical coordinates as $(\sqrt{2}, \frac{\pi}{4}, \frac{\pi}{2})$
on the sketch of this surface

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4)For a particle moving along the space curve given by $\mathbf{r} = 2t\mathbf{i} + \frac{1}{t}\mathbf{j} + (t - 1)^3\mathbf{k}$

a)Evaluate $\frac{d^2\mathbf{r}}{dt^2}$ at $t = 1$

b)Determine the curvature at $t = 1$

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5)For a particle moving in space

$\frac{d^2\mathbf{r}}{dt^2} = 9\sin 3t\mathbf{i} + 9\cos 3t\mathbf{j} + 4\mathbf{k}$ where $\mathbf{r}(0) = 3\mathbf{i} + 4\mathbf{j}$ and $\frac{d\mathbf{r}(0)}{dt} = 2\mathbf{i} - 7\mathbf{k}$

a) Evaluate $\frac{d\mathbf{r}}{dt}$

b)Determine its position vector, $\mathbf{r}(t)$