Assignment Previewer

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Chapter 3 Homework (508317)

About this Assignment

Description

Assignment on chapter 3. Remember not to send me emails, guys.

1. SerPSE7 3.P.005. [737473] Show Details

If the polar coordinates of the point (x , y) are (r , θ), determine the polar coordinates for the following points. (Use r for r and theta for θ as necessary.)

(a) ($-x$, y)

$r =$

$\theta =$

(b) ($-2x$, $-2y$)

$r =$

$\theta =$

(c) ($3x$, $-3y$)

$r =$

$\theta =$

symbolic formatting help

2. SerPSE7 3.P.015. [737486] Show Details

A vector has an x component of 25.5 units and a y component of 43.0 units. Find the magnitude and direction of this vector.

units

° (from the positive x axis)

3. SerPSE7 3.P.033. [737485] Show Details

Vector $\vec{B}$ has x, y, and z components of 2.00, 8.00, and 1.00 units, respectively. Calculate the magnitude of $\vec{B}$.

Calulcate the angle that $\vec{B}$ makes with the x axis.

°

Calculate the angle that $\vec{B}$ makes with the y axis.

°

Calculate the angle that $\vec{B}$ makes with the z axis.

°

4. SerPSE7 3.P.049. [737519] Show Details

An air-traffic controller observes two aircraft on his radar screen. The first is at altitude 900 m, horizontal distance 19.9 km, and 23.0° south of west. The second aircraft is at altitude 1000 m, horizontal distance 17.4 km, and 18.0° south of west. What is the distance between the two aircraft? (Place the x axis west, the y axis south, and the z axis vertical.)

km

5. SerPSE7 3.P.055. [737480] Show Details

After a ball rolls off the edge of a horizontal table at time $t = 0$, its velocity as a function of time is given by the following equation.

$$\vec{v} = 1.7\hat{i}\frac{m}{s} - 9.8t\hat{j}\frac{m}{s^2}$$

The ball's displacement away from the edge of the table, during the time interval of 0.370 s during which it is in flight, is given by the following integral.

$$\Delta\vec{r} = \int_0^{0.370\ s} \vec{v}\,dt$$

To perform the integral, you can use the calculus theorem below.

$$\int\left[A + Bf(x)\right]dx = \int A\,dx + B\int f(x)\,dx$$

You can think of the units and unit vectors as constants, represented by A and B. Do the integration to calculate the displacement of the ball.

$\hat{i}$

$\hat{j}$

6. SerPSE7 3.P.056. [737554] Show Details

Find the sum of these four vector forces: 14.0 N to the right at 35.0° above the horizontal, 31.0 N to the left at 55.0° above the horizontal, 8.40 N to the left at 35.0° below the horizontal, and 25.0 N to the right at 55.0° below the horizontal. (Hint: Make a drawing of this situation and select the best axes for x and y so that you have the least number of components. Then add the vectors by the component method.)

N at ° counterclockwise from the horizontal to the right

SOLUTIONS TO PROBLEMS OF CHAPTER 3

"The solutions are using values given on the book"

PROBLEM 1 (PROBLEM 5 OF BOOK CHAPTER)

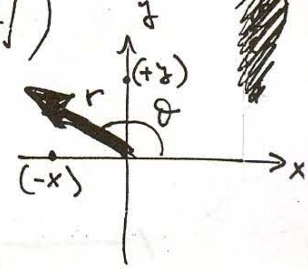
Given rectangular coordinates, we find the polar ones by using

$$r = \sqrt{x^2+y^2} \quad \text{and} \quad \theta = \tan^{-1}\left(\frac{y}{x}\right)$$

a) $(-x, y)$: The radius is $\sqrt{(-x)^2+(+y)^2} = \sqrt{x^2+y^2} = r$

The angle $\tan^{-1}\left(\frac{y}{(-x)}\right) = \tan^{-1}\left(-\left[\frac{y}{x}\right]\right)$

Therefore the angle is $180° - \theta$



b) $(-2x, -2y)$: Radius $\sqrt{(-2x)^2+(-2y)^2} = 2\sqrt{x^2+y^2} = 2r$

angle $180° + \theta$

c) $(3x, -3y)$: Radius $\sqrt{(3x)^2+(-3y)^2} = 3\sqrt{x^2+y^2} = 3r$

angle $-\theta$

PROBLEM 2 (PROBLEM 15 OF BOOK)

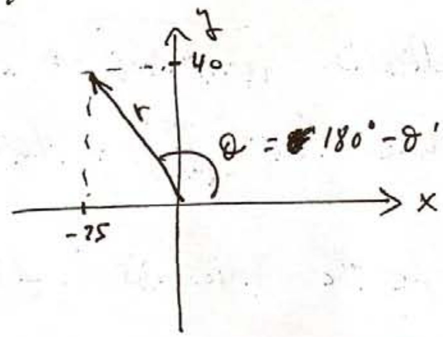
$x = -25.0\ u$

$y = 40.0\ u$

$r = \sqrt{x^2+y^2} = \sqrt{(-25.0)^2 + (40.0)^2} = 47.2$ units

$\theta' = \tan^{-1}\left(\frac{y}{x}\right) = \tan^{-1}\left(\frac{40}{-25}\right) = 58.0°$

therefore $\theta = 180° - 58.0° = 122°$



PROBLEM 3 (PROBLEM 33 OF BOOK)

$\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k} = 4.00\hat{i} + 6.00\hat{j} + 3.00\hat{k}$

Magnitude: $|\vec{B}| = \sqrt{4.00^2 + 6.00^2 + 3.00^2} = 7.81$

Angle with respect to x (α) $\alpha = \cos^{-1}\left(\frac{B_x}{|B|}\right) = \cos^{-1}\left(\frac{4.00}{7.81}\right) = 59.2°$

Angle with respect to y (β) $\beta = \cos^{-1}\left(\frac{B_y}{|B|}\right) = \cos^{-1}\left(\frac{6.00}{7.81}\right) = 39.8°$

Angle with respect to z (γ) $\gamma = \cos^{-1}\left(\frac{B_z}{|B|}\right) = \cos^{-1}\left(\frac{3.00}{7.81}\right) = 67.4°$

PROBLEM 4 (PROBLEM 49 OF BOOK)

The position vector for the first plane, with respect to an origin placed at the controller position (ground) is:

$$\vec{r}_1 = (19.2\,\text{km})\cos 25^\circ\,\hat{i} + (19.2\,\text{km})\sin 25^\circ\,\hat{j} + (0.8\,\text{km})\,\hat{k}$$

$$\vec{r}_1 = (17.4\,\hat{i} + 8.11\,\hat{j} + 0.8\,\hat{k})\,\text{km}$$

For the second we obtain:

$$\vec{r}_2 = (17.6\,\text{km})\cos 20^\circ\,\hat{i} + (17.6\,\text{km})\sin 20^\circ\,\hat{j} + (1.1\,\text{km})\,\hat{k}$$

$$\vec{r}_2 = (16.5\,\hat{i} + 6.02\,\hat{j} + 1.1\,\hat{k})\,\text{km}$$

Displacement from the first plane to the second is:

$$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1 = (-0.863\,\hat{i} - 2.09\,\hat{j} + 0.3\,\hat{k})\,\text{km}$$

with magnitude

$$|\Delta\vec{r}| = \sqrt{(0.863)^2 + (-2.09)^2 + (0.3)^2} = 2.29\,\text{km}$$

PROBLEM 5 (PROBLEM 55 OF BOOK)

$$\Delta\vec{r} = \int_0^{0.380\,s} \vec{v}\,dt = \int_0^{0.380\,s} \left(1.2\,\hat{i}\,\frac{m}{s} - 9.8\,t\,\hat{j}\,\frac{m}{s^2}\right) dt =$$

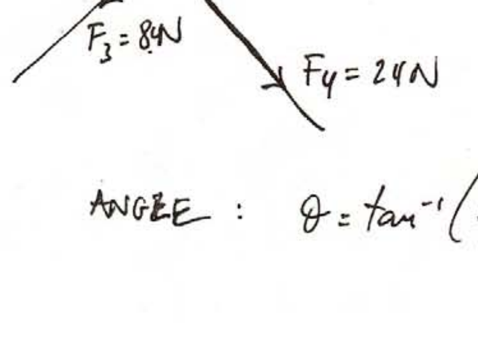
$$= 1.2\,t\,\hat{i}\,\frac{m}{s}\Big|_0^{0.38\,s} - 9.8\,\hat{j}\,\frac{m}{s^2}\,\frac{t^2}{2}\Big|_0^{0.38\,s} =$$

$$= \left(1.2\,\hat{i}\,\frac{m}{s}\right)(0.38\,s - 0) - 9.8\,\hat{j}\,\frac{m}{s^2}\left(\frac{(0.38\,s)^2 - 0}{2}\right) =$$

$$\boxed{\Delta\vec{r} = 0.456\,\hat{i}\,m - 0.708\,\hat{j}\,m}$$

PROBLEM 6 (PROBLEM 56 OF BOOK)

We make a change in the system of reference, by placing the x-axis along the direction of the first force (y-axis 90° ccw)



TOTAL FORCE :

$$\vec{R} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4$$

$$\vec{R} = 12.0\,\hat{i} + 31.0\,\hat{j} - 8.40\,\hat{i} - 24.0\,\hat{j}$$

$$\boxed{\vec{R} = (3.60\,\hat{i} + 7.00\,\hat{j})\,N}$$

MAGNITUDE $\boxed{|\vec{R}| = \sqrt{(3.60)^2 + (7.00)^2} = 7.87\,N}$

ANGLE : $\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right) = \tan^{-1}\left(\frac{7.00}{3.60}\right) = 62.8° \Rightarrow \boxed{\theta' = 62.8° + 35°}$