Chapter 3 – Homework Solution

1. q3.1

Two vectors are given by
$\mathbf{A}$ = (4.0 m)$\mathbf{i}$ – (5.8 m)$\mathbf{j}$ + (d_1 m)$\mathbf{k}$ and $\mathbf{B}$ = (-1.0 m)$\mathbf{i}$ + (3.5 m)$\mathbf{j}$ + (d_2 m)$\mathbf{k}$

If $\mathbf{C} = \mathbf{A} + \mathbf{B}$, find the y component of the vector **C**.

Give the answer in *m* and give only 2 significant digits.

Cy = Ay + By=-5.8+3.5= -2.3

2. q3.2

Two vectors are given by
$\mathbf{A}$ = (4.0 m)$\mathbf{i}$ – (3.0 m)$\mathbf{j}$ + (2.3 m)$\mathbf{k}$ and $\mathbf{B}$ = (-1.0 m)$\mathbf{i}$ + (1.5 m)$\mathbf{j}$ - (5.9 m)$\mathbf{k}$

If $\mathbf{C} = \mathbf{A} - \mathbf{B}$, find the z component of the vector **C**.

Give the answer in *m* and give only 2 significant digits.

Cz = Az - Bz= 2.3– (-5.9) = 8.2

3. q3.3

Two vectors are given by
$\mathbf{A}$ = (-6.5 m)$\mathbf{i}$ – (3.1 m)$\mathbf{j}$ + (d_1 m)$\mathbf{k}$ and $\mathbf{B}$ = (-1.0 m)$\mathbf{i}$ + (2.0 m)$\mathbf{j}$ + (1.3 m)$\mathbf{k}$

If $\mathbf{A} - \mathbf{B} + \mathbf{C} = \mathbf{0}$, find the *x* component of the vector **C**.

Give the answer in *m* and give only 2 significant digits.

$\mathbf{C} = \mathbf{B} - \mathbf{A}$; therefore Cx = Bx – Ax =-1.0 – (-6.5) = 5.5

4. q3.4

The two vectors **A** and **B** in the fig. 1 have magnitudes 3.6 and 3.6 respectively. The angles are $\theta_1 = 30^o$ and $\theta_2 = 105^o$. Find the y components of their vector sum **R**

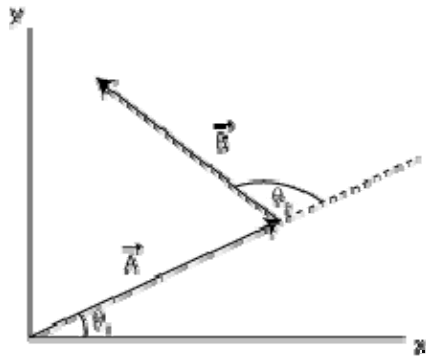

Fig.1

Give the answer to 2 significant digits.

Ry = Ay + By = A Sin(30) + B Sin (135) = 4.3

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5. q3.5

The two vectors **A** and **B** in the fig. 1 have magnitudes 5.6 and 6.2 respectively. The angles are $\theta_1 = 30^o$ and $\theta_2 = 105^o$. Find the magnitude of their vector sum **R**

Give the answer to 2 significant digits.

Rx = Ax + Bx = 5.6 Cos(30)+ 6.2 Cos(135) = -0.2414
Ry = Ay + By = 5.6 Sin(30)+ 6.2 Sin(135) = 7.184
R = Sqrt (Rx^2+ Ry^2) = 7.2

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6. q3.6

The two vectors **A** and **B** in the fig. 1 have magnitudes 7.6 and 1.2 respectively. The angles are $\theta_1 = 30^o$ and $\theta_2 = 105^o$. Find the angle their vector sum **R** makes with the positive direction of the *x*-axis.

Give the answer in degrees and to 2 significant digits.

Rx = Ax + Bx = 7.6 Cos(30)+ 1.2 Cos(135) = 5.733
Ry = Ay + By = 7.6 Sin(30)+ 1.2 Sin(135) = 4.649
$\theta = \tan^{-1}(4.649/5.733)$ = 39

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7. q3.7

The three vectors **A**, **B**, and **C** are shown in the Fig. 2. The magnitudes of **A** is 4.7. Find **A·B**

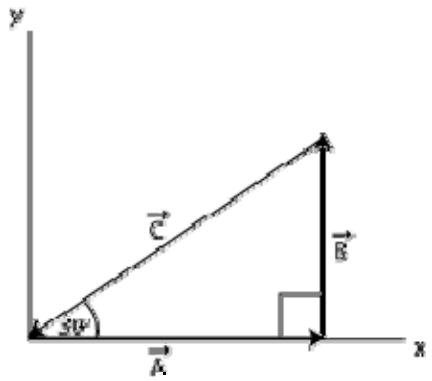

Fig.2

A·B = A B Cos (90) = 0

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8. q3.8

The three vectors **A**, **B**, and **C** are shown in the Fig. 2. The magnitudes of **A** is 1.7. Find **A·C**

Give the answer to only 2 significant digits.

A·C = A C Cos (180 – 30) = A {-C Cos (30)} = A {-A} = $\boxed{-2.9}$;
note that the angle between the vectors A and C is not 30, but 150! **Bring the tail end of the two vectors together to determine the angle between them**

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9. q3.9

The three vectors **A**, **B**, and **C** are shown in the Fig. 2. The magnitude of A is 3.6. Find **B·C**

Give the answer to only 2 significant digits.

B·C = B C Cos(180 – 60) = B {-C Cos(60)} = B {-B} = - B^2 = - $(A \tan 30)^2$ = - $(3.6 \tan(30))^2$ = $\boxed{-4.3}$

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10. q3.10

The three vectors **A**, **B**, and **C** are shown in the Fig. 2. The magnitude of A is 2.7. Find the magnitude of **A x B**

Give the answer to only 2 significant digits.

|A x B| = A B Sin 90 = A B = A (A tan(30)) = $\boxed{4.2}$

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11. q3.11

The three vectors **A**, **B**, and **C** are shown in the Fig. 2. The magnitude of **A** is 3.1. Find the magnitude of **A x C**

Give the answer to only 2 significant digits.

|A x C| = A C Sin(180 – 30) = A C Sin (30) = = A {A/Cos(30)} Sin(30) = A2 tan(30) = = 5.5

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12. q3.12

The three vectors **A**, **B**, and **C** are shown in the Fig. 2. The magnitude of A is 3.5. Find the direction of **A x C**. (The positive z-direction is out of the screen)

Bring the tail ends of the two vectors A and C together; then apply the right hand rule to get the direction to into the screen, i.e. negative z-direction.