مسائل الفصل الأول
الكميات الفيزيائية وتحليل المتجهات

(1)

حجم المكعب:

$$V = L^3$$

تعطى الكثافة بالعلاقة :

$$\rho = \frac{m}{V} = \frac{m}{L^3} = \frac{350\times10^{-3}}{5\times10^{-2}} = 7Kg/m^3$$

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(2)

حجم الكرة:

$$V = \frac{4}{3}\pi r^3$$

تعطى الكثافة بالعلاقة :

$$\rho = \frac{m}{V} = \frac{m}{\frac{4}{3}\pi r^3} = \frac{5.64\times10^{26}}{\frac{4}{3}\times3.14\times(6\times10^7)^3} = 623.67Kg/m^3$$

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(4)

تعطى الكثافة بالعلاقة :

$$\rho = \frac{m}{V} = \frac{m}{\pi r^2 L}$$

سماكة القرص:

$$\Rightarrow L = \frac{m}{\pi r^2 \rho} = \frac{62}{3.14\times(0.243)^2\times8.93\times10^3} = 0.037m$$

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(7)

$$F = G\frac{Mm}{r^2}$$

$$\Rightarrow G = F\frac{r^2}{Mm} = \frac{\left(\frac{Kgm}{s^2}\right)m^2}{Kg^2} = m^3/Kg^3s^2$$

(8)

أ)
تعطى مساحة الكرة :

$$m = 4\pi r^2$$

$$\frac{m_E}{m_M} = \frac{4\pi r_E^2}{4\pi r_M^2} = \frac{r_E^2}{r_M^2} = \frac{(6.37\times10^6)^2}{(1.74\times10^6)^2} = 13.40$$

ب)
يعطى حجم الكرة :

$$V = \frac{4}{3}\pi r^3$$

$$\frac{V_E}{V_M} = \frac{\frac{4}{3}\pi r_E^3}{\frac{4}{3}\pi r_M^3} = \frac{r_E^3}{r_M^3} = \frac{(6.37\times10^6)^3}{(1.74\times10^6)^3} = 49.06$$

ج)

$$\rho = 5.5\frac{g}{cm^3} = 5.5\times\frac{10^{-3}Kg}{10^{-6}m^3} = 5.5\times10^3\frac{Kg}{m^3}$$

$$\rho = \frac{m}{V} = \frac{m}{\frac{4}{3}\pi r^3}$$

$$\Rightarrow m = \rho\frac{4}{3}\pi r^3 = 5.5\times10^3\times\frac{4}{3}\times3.14\times(6.37\times10^6)^3 = 5951814.28Kg$$

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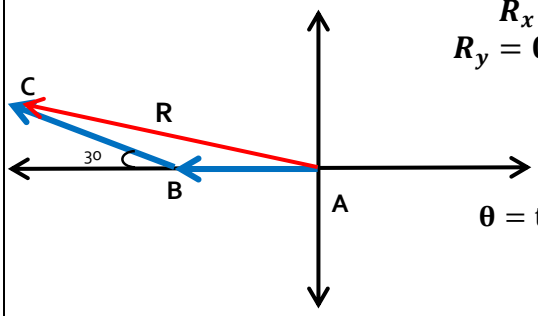
(12)



$$R_x = -AB - BC\,cos30° = -200 - 300\,cos30° = -459.8\,km$$
$$R_y = 0 + BC\,sin30° = 300\,sin\,30° = 150\,km$$
$$R = -459.8\,\hat{\imath} + 150\,\hat{\jmath}\ km$$
$$|R| = \sqrt{{R_x}^2 + {R_y}^2} = \sqrt{(-459.8)^2 + (150)^2} = 483.65\,km$$
$$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right) = \tan^{-1}\left(\frac{150}{-459.8}\right) = -18.07°$$

الاشارة السالبة تعني ان الزوايه اتجاهها مع عقارب الساعة
والمحصلة تقع في الربع الثاني لحساب الزاويه مع محور Xالموجب

$$\theta = 180° - 18.07° = 161.93°$$

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(14)

أ)الرسم البياني
المحصلة بيانيا A+B و A-B:

(a) Using graphical methods, place the tail of vector **B** at the head of vector **A**. The new vector **A** + **B** has a magnitude of 6.1 at 112° from the *x*-axis.

(b) The vector difference **A** − **B** is found by placing the negative of vector **B** at the head of vector **A**. The resultant vector **A** − **B** has magnitude 14.8 units at an angle of 22° from the + *x*-axis.

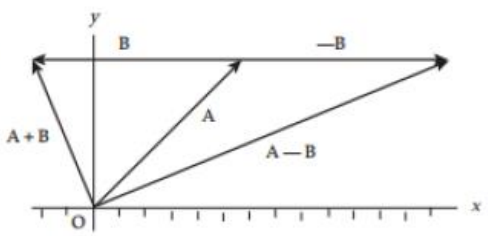
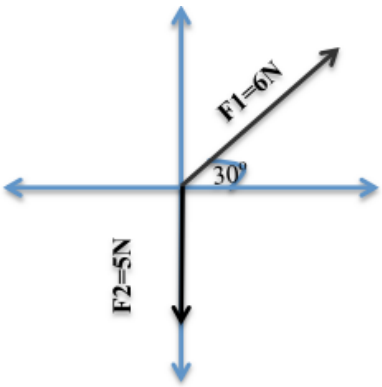
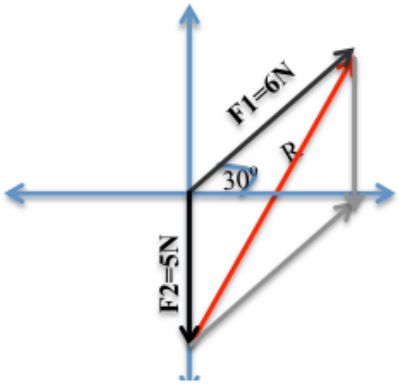


FIG. P3.10

(15)





$$F_x = F_1 cos30° + 0 = 6\, cos30° = 5.19\ N$$

$$F_y = F_1\, sin30°\ - 5 = 6\, sin\ 30° - 5 = -2\ N$$

$$\mathbf{F = 5.19\,\hat{i} - 2\,\hat{j}\ N}$$

$$\mathbf{|F| = \sqrt{F_x^{\,2} + F_y^{\,2}} = \sqrt{(5.19)^2 + (-2)^2} = 5.56\ N}$$

$$\mathbf{\theta = \tan^{-1}\left(\frac{F_y}{F_x}\right) = \tan^{-1}\left(\frac{-2}{5.19}\right) = -21.07°}$$

الاشارة السالبة تعني ان الزوايه اتجاهها مع عقارب الساعة

والمحصلة تقع في الربع الرابع لحساب الزاويه مع محور X الموجب

$$\mathbf{\theta = 360° - 21.07° = 338.93°}$$

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it will be done in the class **(16)**

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(19)

(a) See figure to the right.

(b) $\mathbf{C = A + B = 2.00\hat{i} + 6.00\hat{j} + 3.00\hat{i} - 2.00\hat{j} = \boxed{5.00\hat{i} + 4.00\hat{j}}}$

$\mathbf{C = \sqrt{25.0 + 16.0}}$ at $\mathbf{\tan^{-1}\left(\frac{4}{5}\right) = \boxed{6.40 \text{ at } 38.7°}}$

$\mathbf{D = A - B = 2.00\hat{i} + 6.00\hat{j} - 3.00\hat{i} + 2.00\hat{j} = \boxed{-1.00\hat{i} + 8.00\hat{j}}}$

$\mathbf{D = \sqrt{(-1.00)^2 + (8.00)^2}}$ at $\mathbf{\tan^{-1}\left(\frac{8.00}{-1.00}\right)}$

$\mathbf{D = 8.06 \text{ at } (180° - 82.9°) = \boxed{8.06 \text{ at } 97.2°}}$

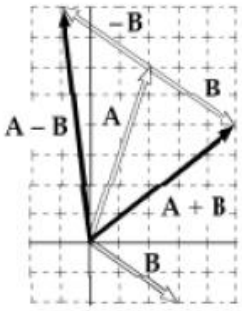

FIG. P3.27

(20)

$\mathbf{A} = -8.70\hat{\mathbf{i}} + 15.0\hat{\mathbf{j}}$ and $\mathbf{B} = 13.2\hat{\mathbf{i}} - 6.60\hat{\mathbf{j}}$

$\mathbf{A} - \mathbf{B} + 3\mathbf{C} = 0$:

$$3\mathbf{C} = \mathbf{B} - \mathbf{A} = 21.9\hat{\mathbf{i}} - 21.6\hat{\mathbf{j}}$$
$$\mathbf{C} = 7.30\hat{\mathbf{i}} - 7.20\hat{\mathbf{j}}$$

or

$$C_x = \boxed{7.30 \text{ cm}}; C_y = \boxed{-7.20 \text{ cm}}$$

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(25)

$$A.B = ABCos\theta = 5\times 9Cos50 = 28.93\ units$$

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(27)

سيكون المتجهان متعامدان إذا كانت الزاوية بينهما ٩٠ درجة .

$$A.B = ABCos\theta = ABCos90 = 0$$
$$A.B = (2i - yj + 4k).(2i - 2j + 2K) = 0$$
$$(2i - yj + 4k).(2i - 2j + 2K) = 4 + 2y + 8 = 0$$
$$y = -6$$

(28)

$$A.B = ABCos\theta$$
$$A = 12i + 10j\ , B = 7i + 8j$$
$$A.B = (12i + 10j\ ).(7i + 8j) = 84 + 80 = 164$$
$$|A| = \sqrt{(12i)^2 + (10j)^2} = 15.62$$
$$|B| = \sqrt{(7i)^2 + (8j)^2} = 10.63$$
$$\Rightarrow Cos\theta = \frac{A.B}{AB} = \frac{164}{15.62\times 10.63} = 0.99$$
$$\theta = Cos^{-1}0.99 = 8.1^o$$