Physical Quantities and Vectors Revision Questions

a) Convert 52 miles per hour to meters per second. Given that 1 mile = 1609 m.

b) The forces shown in Figure 1 are in equilibrium. Find the resultant force and its direction.

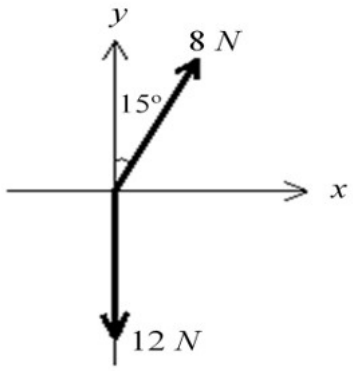


Figure 1

c) Given vector F1 and F2 are in the x-y plane. F1 is 60 N at 48o and F2 is 90 N at 110o counterclockwise. Find the magnitude and direction of the resultant vector. Ans: 129.5 N, 85.9° Q1.

d) Two forces of magnitudes 3.0 N and 4.0 N act on an object. Determine how the directions (same directions, opposite direction or perpendicular direction) of the two forces related if

i) the net force has magnitude 7.0 N,

ii) the net force has magnitude 5.0 N.

iii) Determine the relationship between the directions gives the smallest magnitude of net force and calculate the magnitude.

e) Convert 1.0 kg/m3 to unit of µg/cm3.

f) Change the following value 5 µm3/hour to unit m3/s.

g) The area of a land is 500 km2. Express this area in mi2. Given 1 mi = 1.6 km.

h) Figure B below shows the forces exerting on an object.

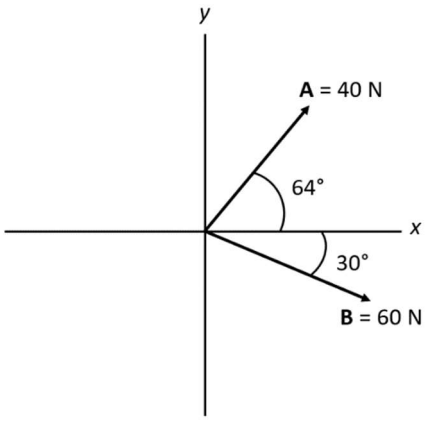


Figure B

i) Find the *x*-component and *y*-component for vector **A**.

ii) Find the *x*-component and *y*-component for vector **B**.

iii) Calculate the net value for the *x*-components.

iv) Calculate the net value for the *y*-components.

v) Calculate the magnitude of the resultant vector.

vi) Determine the direction of the resultant vector.

i) A certain fuel-efficient hybrid car has gasoline mileage of 65 mpg (miles per gallon). Given 1 gallon = 3.788 liters, 1 miles = 1.609 km.

(i) If you are driving this car in Europe and want to compare its mileage with that of other European cars, express this mileage in km/L (L = liter).

(ii) If this car's gas tank holds 40 L, calculate the number of tanks of gas you will use to drive 1800 km.

j) Find the net force acting on the system shown in Figure 2. Given forces F_1, F_2, F_3 and F_4 are 5 N each.

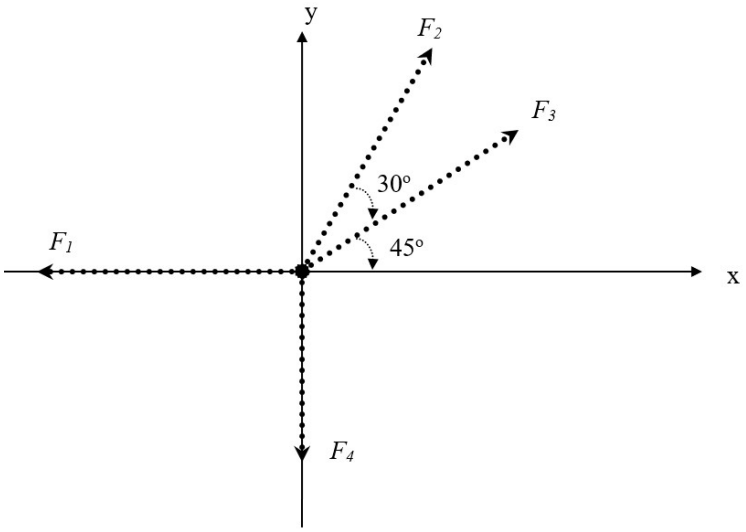
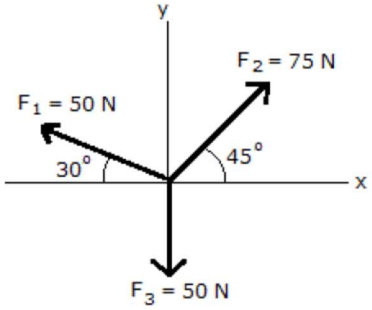


Figure 2

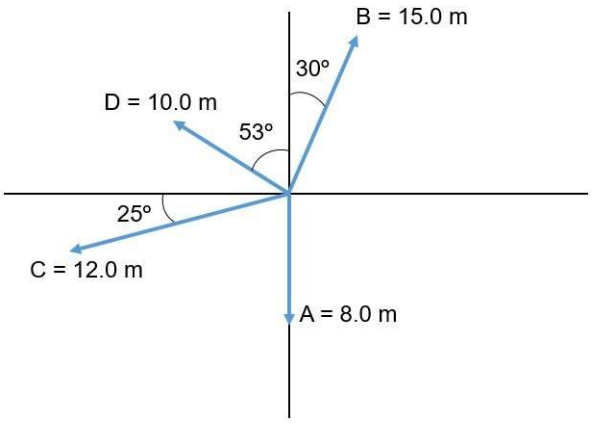
k) Determine the magnitude and direction of the resultant force by adding the rectangular components of the three forces in Figure below.



l) Covert the following to SI units:

(i) 76.5 cm / ms
(ii) 150 ng / mm^3

m) Figure below shows vectors **A, B, C** and **D** with their respective directions.



(i) Determine the *x* and *y* components for each vectors.
(ii) Find the magnitude and direction of the resultant vector.

n) Consider the vectors A, B and C shown in **Figure 5** below.

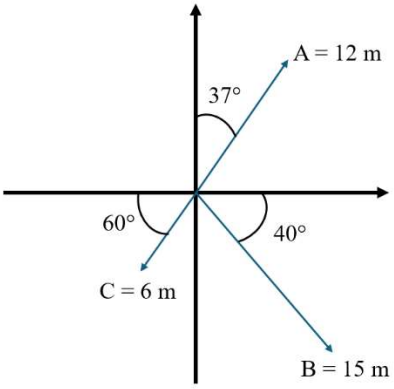


Figure 5

i) Find the *x*-component and *y*-component for vector A**.**
ii) Find the *x*-component and *y*-component for vector B**.**
iii) Find the *x*-component and *y*-component for vector C**.**
iv) Calculate the net value for the *x*-components.
v) Calculate the net value for the *y*-components.
vi) Calculate the magnitude of the resultant vector.
vii) Determine the direction of the resultant vector.

o) What is the resultant force on the box in **Figure 1** below?

Figure 1

p) Convert 150 g/cm^3 to kg/m^3.

q) Mr. Bean is considering buying a European car and wants to see if its advertised fuel efficiency (expressed in km/L) is better than that of his present car. If his car gets 37.3 miles per gallon, how many km/L is this? Given 1 gallon = 3.788 liters, 1 miles = 1.609 km.

r) Position as a function of time equation is given as:

$$x(t) = 2.5t^3 - 6.1t^2 - 3t + 9$$

Determine the instantaneous acceleration of the motion at t = 1.5 s.

Answers:

a) 23.24 m/s
b) 4.75 N, 64° Q4
c) 129.5 N, 85.9° Q1.
d) i) Same directions ii) Perpendicular directions iii) Opposite directions, 1 N
e) 1000 µg/cm3
f) 1.39x10-21 m3/s
g) 195.3mi2
h) i) $+17.53\ N, +35.95\ N$ ii) $+51.96\ N, -30\ N$ iii) $147.53\ N$
iv) $21.96\ N$ v) $149.16\ N$ vi) $8.47°\ at\ the\ Q1$
i) i) 27.61 km/L ii) 2 tanks
j) 3.37 N, 87.11° at Q2
k) 24.03 N, 66.1° at Q4
l) i) 765 m/s ii) 0.15 kg/m^3
m) i) $A_x = 0$ ii) 12.83 m, 27.58° at Q2
$A_y = -8m$
$B_x = 7.5m$
$B_y = 12.99m$
$C_x = -10.88m$
$C_y = -5.07m$
$D_x = -7.99m$
$D_y = 6.02m$
n) i) A_x = 7.22 m, A_y = 9.58 m
ii) B_x = 11.49m, B_y = -9.64m
iii) C_x = -3m, C_y = -5.2m
iv) 15.71m
v) -5.26m
vi) 16.57m
vii) 18.51° at Q2
o) 1N to the left
p) 1.5 × 10^5 kg/m^3
q) 15.8 km/L
r) 10.3 m/s^2