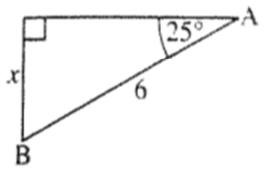
TUTORIAL QUESTION

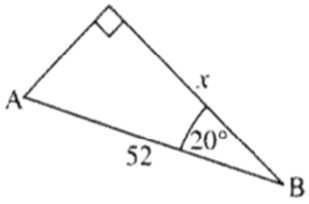
TOPIC 1 PHYSICAL QUANTITIES & UNITS

1.) Find the value of x.

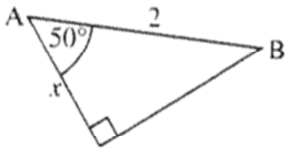
(a)



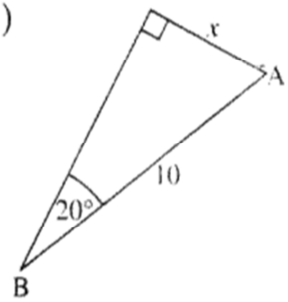
(c)



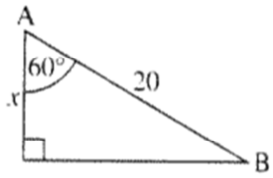
(e)



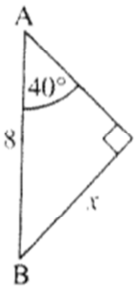
(b)



(d)



(f)



2.) Find the resultant vector for part (a.) to (e.)

a.) A displacement of 12 km south followed by a displacement of 5 km east.

b.) A displacement of 5 km east followed by a displacement of 12 km south. Is there any difference between your answer to this question and the answer to question 1?

c.) A velocity of 24 ms^{-1} north and a velocity of 7 ms^{-1} east.

d.) A force of 12 N west and a force of 16 N south.

e.) Displacements of 10 m east and 12 m north east.

3.) An aircraft, flying with an engine speed of 400 kmh^{-1}, is set on a course due north, in a wind of speed 60 kmh^{-1} from the south west. At what speed and in what direction is the aircraft covering the ground?

4.) A stone is thrown up at an angle of 20^{o} to the vertical with an initial velocity of 35 ms^{-1}. what are the initial horizontal and vertical components of the velocity of the stone?

5.) A train is travelling at 125 mph on a railway line that runs N24^{o}E. Find the horizontal and vertical components of the velocity of the train.

6.) The drag coefficient C_D of a car moving with speed v through air of density ρ is given by $C_D = \frac{F}{(\frac{1}{2}\rho v^2 A)}$

where F is the drag force exerted on the car and A is the maximum cross-sectional area of the car perpendicular to the direction of travel. Show that C_D is dimensionless.

7.) The experimental measurement of the heat capacity C of a solid as a function of temperature T is to be fitted to the expression $C = \alpha T + \beta T^3$. What are possible units for α and β?

8.) a.) The kilogram, metre and second are base units. Name two other base units.

b.) Explain why the unit of energy is said to be a derived unit.

c.) The density, *ρ* and pressure, p of a gas are related by the expression

$$c = \sqrt{\frac{\gamma \mathrm{p}}{\rho}}$$

where c and γ are constants.

i.) Determine the base unit for density *ρ*

ii.) Show that the units for pressure p are $kgm^{-1}s^{-2}$

iii.) Given that constant γ has no unit, determine the unit of c.

iv.) Suggest what quantity may be represented by the symbol c.

9.) Which expression could be correct for the velocity v of ocean waves in terms of ρ the density of sea-water, g the acceleration of free fall, h the depth of the ocean and λ the wavelength?

A.) $\sqrt{g\lambda}$ B.) $\sqrt{\frac{g}{h}}$ C.) $\sqrt{\rho g h}$ D.) $\sqrt{\frac{g}{\rho}}$

10.) If p is momentum of an object of mass m, the expression p^2 / m has base units identical to

A.) energy B.) force C.) power D.) velocity

11.) Which quantity has different units from the other three?

A.) density x volume x velocity

B.) rate of change of momentum

C.) the Young Modulus x area

D.) weight