



BGE-131-3  
Basic Mathematics and Engineering Technology

1. a. Write equations for speed ( $v$ ), velocity and acceleration ( $a$ ) for moving object identifying all the parameters in the equations.  
(10 mark)
- b. Velocity is different from speed. Explain. A car travels 800 m in 15 s. What is its average speed?  
(5 mark)
- c. A van takes 8 s to increase its velocity from 10 m/s to 30 m/s. What is its average acceleration?  
(5 mark)
- d. A racing car starting from rest accelerates at a constant rate of 5.00 m/s<sup>2</sup>. What is the velocity of the car after it has travelled 1 km? Suppose the driver now applies the brakes stopping the car in 4.00 s, find (a) the deceleration and (b) the distance the car travels, assuming that the deceleration is constant.  
(15 mark)
- e. A rocket moves upward starting from rest with an acceleration of 29.4 m/s<sup>2</sup>. It runs out of fuel after 8 s later and continue coast upward, reaching maximum height, before falling back to Earth.
- (i). Find the rocket velocity and position at the end of 4 s.
  - (ii). Find the maximum height the rocket reaches.
  - (iii). Find the velocity the instant before the rocket crashes on the ground.
- (15 mark)
2. a. What is a force? Write the SI unit of force.  
(5 mark)
- b. A car traveling at a constant speed of 24 m/s passes a motor bicycle hidden behind a billboard. One second after the speeding car passes the billboard; the bicycle sets off in chase with a constant acceleration of 3 m/s<sup>2</sup>.

(i). How long does it take the bicycle to overtake the speeding car?

(10 mark)

(ii). How fast is the bicycle going at that time?

(10 mark)

c. Write Newton's laws of motion.

(5 mark)

(i). An object with a mass of 200 kg is pulled with a rope. This gives an acceleration of  $0.5 \text{ m/s}^2$  to the object. What is the tension of the rope if you neglect the friction of the surface.

(10 mark)

(ii). A mass of 1500 kg is accelerated at  $3g$ , where  $g = 9.8 \text{ m/s}^2$ . What would be the net force of this mass?

(10 mark)

### Part C

1. a. Solve following for  $x$ .

i.  $x^2 + 7x + 5$

(10 Mark)

ii.  $2x^2 - x - 1 < 0$

(10 Mark)

iii.  $5x^{2/3} - 2 = 43$

(10 Mark)

iv.  $2 \times 5^{x-1} = 15$

(10 Mark)

b. Graph below functions.

i.  $f(x) = \begin{cases} x + 6 & \text{if } x < -2 \\ x^2 & \text{if } x \geq -2 \end{cases}$

(10 Mark)

c. If  $X = \begin{vmatrix} -1 & 0 & 3 \\ 2 & 1 & 1 \end{vmatrix}$  and  $Y = \begin{vmatrix} -1 & 1 & 2 \\ 1 & 3 & 0 \\ 1 & 0 & 1 \end{vmatrix}$  find the product  $XY$ .

(10 Mark)

2. a. Find each of the following limits, if they exist

i.  $\lim_{x \rightarrow 2} \left( \frac{x^3 - 8}{x - 2} \right)$  (5 Mark)

ii.  $\lim_{x \rightarrow \infty} \left( \frac{6x - 5}{4x + 7} \right)$  (5 Mark)

iii. Differentiate the functions with respect to x.

$f(x) = \frac{e^x}{\cos x}$  (7 Mark)

iv. Water pours into a fish tank at a rate of 6 ft<sup>3</sup>/min. How fast is the water level rising if the base of the tank is a rectangle dimension of 8 ft<sup>2</sup>.

(8 Mark)

b. Integrate the followings.

i.  $\int_a^b x^2 dx$  (7 Mark)

ii.  $\int (5e^x + \cos x) dx$  (8 Mark)

