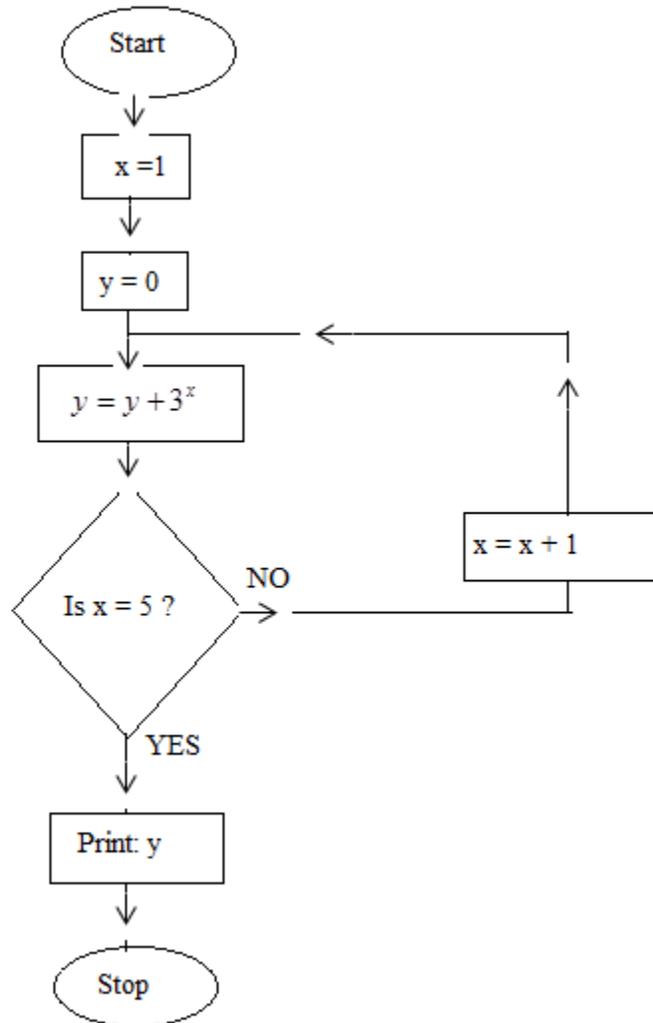


## SECTION A

1. X is a continuous random variable whose cdf is ;  $F(x) = \begin{cases} \lambda x^3; & 0 \leq x \leq 3 \\ 1; & x \geq 3 \end{cases}$ . Find ;
  - a) the value of the constant
  - b)  $P\left(x > \frac{1}{x} < 2\right)$
2. A body of mass 0.4 kg is at rest on a rough horizontal surface .If the coefficient of friction is 0.5. Find the;
  - (i) angle of friction
  - (ii) magnitude of the least force that will move the body against the surface.
3. A weighing machine is corrupted such that a mass of 2kg is recorded as a 1.5 kg and a 5 kg mass is recorded as a 4kg .Estimate using linear approximation,
  - (i) what mass is recorded as 2.25kg.
  - (ii) the mass that is recorded accurately.
4. The resultant of a system of forces  $\left(\begin{matrix} 2 \\ 4 \end{matrix}\right)$  N, the point (3,2) lies on the action of the resultant force .Find the;
  - (i) equation of the line of the resultant.
  - (ii) value of the moment that when added to the system the line of the resultant force will pass through the point (0,0)
5. In a frequency table ,it was recorded that  $\sum fx^2=10,000$ ,  $\sum fx =600$  and the standard deviation was calculated as 5. Calculate  $\sum f$ .
6. A particle P is projected vertically upwards with a speed of  $u \text{ ms}^{-1}$  from a point o on the ground; while at its highest point a second particle is projected vertically upwards with a speed  $2u \text{ ms}^{-1}$  from point O. The particles collide at a point which is at a distance  $x$  m from the highest point of P. Prove that;  $u^2=32gx$ .
7. The probability that a star player of a football team will play in any game is 0.8 . The probability that the team wins a game when the star player is in the team is 0.75, otherwise it is 0.5. Find the probability that the
  - (i) team will win a game
  - (ii) star player is in the team if they lose the game.

8. Study the flow chart below;



Perform a dry run for the flow chart and suggest its purpose.

### SECTION B:

9. (a) Evaluate  $\int_0^1 \frac{x}{1+x^2} dx$  correct to 3 decimal places

(b) Use the trapezium rule with 6 ordinates to estimate  $\int_0^1 \frac{x}{1+x^2} dx$  correct to 3 decimal places

;hence state the absolute error in your answer.

10. X is a discrete random variable such that;

$$P(X = x) = \begin{cases} kx, \dots x = 3, 4, 5 \\ k2^x; \dots x = 1, 2 \\ 0; \text{elsewhere} \end{cases}$$

- (a) Find the value of the constant k, hence find ;
- $P(x \geq 2)$
  - the variance of X
- (b) Sketch the graph of  $P(X = x)$

11. Relative to an observer in a motor boat travelling at  $10 \text{ kmh}^{-1}$  due South, a steamer appears to travel at  $40\sqrt{2} \text{ kmh}^{-1}$  due North- west;

- Find the magnitude and direction of the actual velocity of the steamer.
- If the initially the boat was 50 km north of the steamer; find the shortest distance between the vessels ,and calculate the time that elapses before this occurs.

12. Study the table below;

Marks	20 - 24	25 - 34	35 - 38	39 - 44	45 - 49	50 - 54
Frequency density	1.2	1	2	1.5	1	0.4

- Construct a histogram using your data.
  - Use the histogram to estimate the mode.
- Calculate the mean mark.

13.(a) Use a graphical method to find the two roots of the equation ;  $x^2 + x - 4 = 0$  correct to 1 dpt.

- Use the Newton- Raphson method to find the negative root of the equation in (a) above correct to 4 decimal places.

14. A particle of mass 0.5 kg acted upon by an accelerating force of  $(12t^2\mathbf{i} - 6t\mathbf{j}) \text{ N}$  passes through point  $P(-2,3)$  with a speed of  $3\mathbf{i} - 4\mathbf{j} \text{ ms}^{-1}$ .

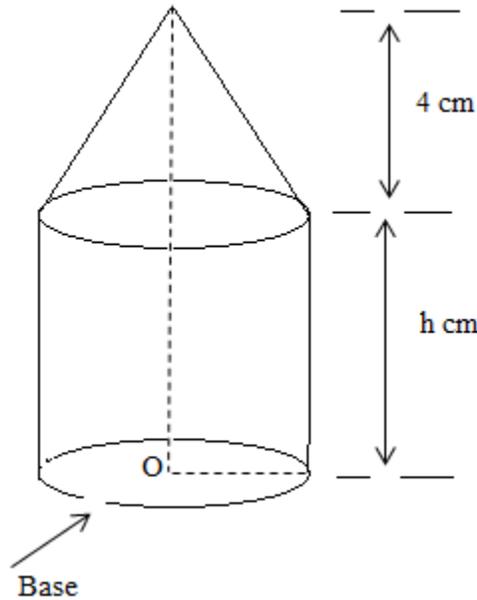
- Find the velocity and position vector of the particle t seconds after passing through point  $P(-2,3)$
- Calculate the;
  - average speed of the particle in the time interval  $t=1$  to  $t=3\text{s}$ .
  - power developed at  $t=2\text{s}$

15. The marks of all the candidates from a certain school in a national examination were normally distributed with a mean of 52% and a standard deviation of 16%. The lowest mark for a distinction was 68%.

- Given that 20 students are below 40%, estimate the number of candidates in the school; hence find the number of candidates who got distinctions
- Sixteen candidates of this school were picked at random, find the probability that their mean score was between 46% and 58%.

16. (a) The figure below shows a uniform solid consisting of the right circular cone and a cylinder. Show that the distance of the centre of gravity of the solid from O is

$$\frac{3h^2 + 8h + 8}{6h + 8} \text{ cm, where } h \text{ is the height of the cylinder.}$$



(b) When the solid in (a) above is placed with its base on a rough plane inclined at  $45^\circ$  to the horizontal it will be at the point of toppling. If the radius of the cylinder is  $2\frac{2}{3} \text{ cm}$ , find the value of  $h$ .

END.