Thursday 17th September, 2020

APPLIED MATHEMATICS

Attempt **all** *the questions*

SECTION A (40 *marks*)

1. Three numbers *a*, *b*, 8, 5 and 7 have mean of 6 and variance of 2. Find *a* and *b* if $a > b$. (*05 marks*)

2. A ball is thrown vertically upwards to a height of 10 m. Find:

(i) the time taken for the ball to reach this height.

(ii) the initial speed of the ball. (*05 marks*)

3. Two stations *A* and *B* are at a distance 6*x* m apart along a straight road. A train starts from rest at *A* and accelerates uniformly to a speed of V ms^{-1}, covering a distance of *x* m. The train then maintains this speed until it has travelled a further 3*x* m. It then retards uniformly to rest at *B*.

(i) Sketch a velocity ─ time graph for the motion of the train.

(ii) Show that the time, *T* taken by the train to move from *A* to *B* is given by $T = \frac{9x}{V}$ (*06 marks*)

4. A class performed an experiment to estimate the diameter of a circular object. A sample of five students had the following results in centimeters: 3.12, 3.16, 2.94, 3.33 and 3.00. Determine the sample:

(i) mean

(ii) standard deviation (*05 marks*)

5. *ABCD* is a rectangle in which *AB* = 4m and *BC* = 3m. A force of magnitude 3N acts along *AB* towards *B*, another force of 4N acts along *AC* towards *C* and a third force of 3N acts along *AD* towards *D*. Find the magnitude of the resultant force and the angle it makes with *AD*.

. (*05 marks*)

6. The sizes of shoes sold in a certain shop in a given week are as shown in the table below.

Size	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
no. of pairs of shoes sold	4	9	11	8	10	7	2	3

Calculate the mean and standard deviation of the sizes of the shoes sold.
(*05 marks*)

7. Three forces $(3i + 5j)$ N, $(4i + 11j)$ N and $(2i + j)$ N act at a point. Find the:
(i) magnitude of the resultant force.
(ii) the angle which the resultant makes with the unit vector i.
(*05 marks*)

8. A particle moves with an initial velocity of $2ms^{-1}$ in a straight line with a constant acceleration of $3ms^{-1}$ for 5 seconds. Find the final velocity and distance covered in this time. (*04 marks*)

SECTION B (36 *marks*)

9. Forces P and Q act along lines OA and OB respectively and their resultant is a force of magnitude P. If a force P along OA is replaced by a force $2P$, the resultant of $2P$ and Q is also a force of magnitude P. Find the:
(i) magnitude of Q in terms of P.
(ii) the angle between OA and OB.
(iii) the angles with which the two resultants make with OA. (*12 marks*)

10. A lift travels vertically upwards from rest at floor A to rest at floor B which is 20m above A in three stages as follows.
The lift first accelerates from A at $2ms^{-2}$ for 2 seconds. It then travels at a constant speed, and finally decelerates uniformly coming to rest at B after a total time of 6.5 seconds.
(a) Sketch a velocity – time graph for the motion of the lift.
(b) Find the magnitude of the constant deceleration.

(c) The mass of the lift and its contents is 500kg. Find the tension in the lift cable during the stage of motion when the lift is:
(i) accelerating upwards
(ii) moving with a constant speed.

(*12 marks*)

11. The table below shows the marks obtained by 120 students in a test.

Marks	No. of students
10─14	5
15─19	15
20─24	35
25─29	10
30─34	25
35─39	8
40─44	7
40─44	5

(a) Calculate the:
(i) mean
(ii) standard deviation of the marks.
(b) Plot an ogive and use it to estimate the:
(i) median
(ii) interquartile range.

(*12 marks*)

Next chapter:
Probability theory

END