APPLIED MATHEMATICS(P425/2)

1. *A discrete* **r·v X** *takes the values* **1, 2** *or* **3** *and its cumulative distribution function is as follows:*

$$F(x) = \frac{(x + k)^2}{16} \quad , \quad x = 1, 2, 3$$

Find the:

(i) *value of* **k** *where* $k > 0$.

(ii) *probability distribution of* **X.**

(iii) *mean and variance of* **X.**

2. *A r·v* **X** *has the following p·d·f*

$$f(x) = \begin{cases} \beta x & , \quad 1 \le x \le 3 \\ \lambda(4 - x) & , \quad 3 < x \le 4 \\ 0 & , \quad \text{otherwise} \end{cases}$$

(a) *Show that* $\lambda = 3\beta$

(b) *Find:*

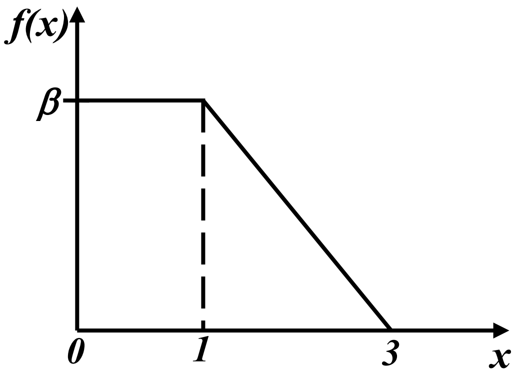
(i) *the values of* β *and* λ

(ii) *the mean of* **X**

(iii) $P(1\cdot5 < X < 3\cdot5 / X < 2)$

(iv) *the upper quartile of* **X**

3. *The p·d·f of a continuous* **r·v X** *is distributed as follows:*



Find:

(i) *the value of* β

(ii) *the equations of the p·d·f , hence or otherwise find the median of X*

4. *The size of an angle* $\boldsymbol{x}$ *was measured with an error* $\Delta\boldsymbol{x}$*. Derive an expression for the maximum relative error in* $\boldsymbol{x\cos x}$*. Hence if* $\boldsymbol{x = 60°}$ *and* $\Delta\boldsymbol{x = 3°}$*, find the limits within which the exact value of* $\boldsymbol{x\cos x}$ *lies.*

5. *Use the trapezium rule with* $\boldsymbol{n}$ *ordinates to show that* $\int_0^1 x^2 dx \approx \frac{1}{3} + \frac{1}{6(n-1)^2}$

6. *A particle is projected from a point O,* $14.7m$ *above a horizontal ground, with a speed of* $21ms^{-1}$ *at an elevation of* $30°$ *below the horizontal. Find the :*

   a) *The time of flight.*
   b) *The range on the ground.*

7. *A particle is projected with a speed of* $36ms^{-1}$ *at an angle of* 40^0 *to the horizontal from a point 0.5m above the level ground. It just clears a wall which is 70 metres on the horizontal plane from a point of projection. Find the;*

   a) *The time taken for particle to reach the wall.*

   b) *The height of the wall.*

8. *A girl thrown a stone from a height of 1.5m above the ground with speed of* $10ms^{-1}$ *and hits a bottle standing on a wall 4m high and 5m from her.*

   Take g = $10ms^{-1}$*. Show that if α is the angle of projection of the stone as it leaves her hand then;* $1.25\tan^2\alpha - 5\tan\alpha + 3.75 = 0$

END: