Properties of Variance :-

(1) $V(a) = 0$ where   a   is constant

Proof: $V(a) = E(a^2) - (E(a))^2$ (By def^n)

$$= a^2 - (a)^2 \qquad (\because E(a) = a) \text{ and } E(a^2) = a^2$$

$$= a^2 - a^2 = 0 \qquad \#$$

(2) $V(ax + b) = a^2 V(x) \blacklozenge$

Proof: $V(ax+b) = E((ax+b)^2) - (E(ax+b))^2$

$$= E(a^2x^2 + b^2 + 2abx) - (aE(x) + b)^2 \qquad \left(\begin{array}{c} \because E(ax+b) \\ = aE(x) + b \end{array} \right)$$

$$= E(a^2x^2) + E(b^2) + E(2abx)$$

$$- (a^2(E(x))^2 + b^2 + 2ab \, E(x))$$

$$= a^2 E(x^2) + b^2 + 2ab \cancel{E(x)} - a^2(E(x))^2 - \cancel{b^2} - 2ab \cancel{E(x)}$$

$$= a^2(E(x^2) - (E(x))^2) = a^2 V(x) \qquad \#$$

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Q: If Mean of X is 2 then find the.
$E(-2X+3)$?

Sol^n

$E(-2X+3) = -2 E(X) +3$ $\left(\because E(aX+b) = aE(X)+b\right.$

$= -2 \cdot 2 +3$ $\left.\because E(X) = 2 \text{ given}\right)$

$= -4+3$

$= -1$

Q: If variance of X is $\sqrt{2}$ then find

(i) $V(-\sqrt{2} X +6)$ (ii) $V(3X)$ (iii) $V(6-4X)$.

Sol^n (i) $V(-\sqrt{2} X +6) = (-\sqrt{2})^2 V(X)$

$= 2 V(X)$

$= 2\sqrt{2}$ #

(ii) $V(3X) = 3^2 V(X)$

$= 9 \times \sqrt{2} = 9\sqrt{2}$

(iii) $V(6-4X) = (-4)^2 V(X)$

$= 16 \times \sqrt{2}$

$= 16\sqrt{2}$ #