$$E(g(X)) = \sum g(x) P(X = x)$$

If X is a random variable, a and b are constants, then

$$E(aX + b) = aE(X) + b$$

If X and Y are random variables,

$$E(X + Y) = E(X) + E(Y)$$

$$V(aX + b) = a^2 Var(X)$$

Exercise 1c

3) $E(X) = 1 \quad Var(X) = 2$

a) $E(8X) = 8 \times 1 = 8$

b) $E(X+3) = E(X) + 3 = 1 + 3 = 4$

c) $Var(X+3) = Var(X) = 2$

d) $Var(3X) = 3^2 Var(X) = 9 \times 2 = 18$

e) $Var(1-2X) = (-2)^2 Var(X) = 4 \times 2 = 8$

f) $E(X)^2 = Var(X) + (E(X))^2 = 2 + 1^2 = 3$

5) $E(x) = \mu \quad Var(x) = \sigma^2$

a) $E(4x) = 4E(x) = 4\mu$

b) $E(2x+2) = 2E(x)+2 = 2\mu+2$

c) $E(2x-2) = 2E(x)-2 = 2\mu-2$

d) $Var(2x+2) = Var(2x) = 2^2 Var(x) = 4\sigma^2$

e) $Var(2x-2) = Var(2x) = 2^2 Var(x) = 4\sigma^2$

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7)

radius	10	15	20
volume	100π	225π	400π
$P(V=v)$	$\frac{6}{20}$	$\frac{9}{20}$	$\frac{5}{20}$

$$E(x) = \frac{1}{20}\left[6 \times 100\pi + 9 \times 225\pi + 5 \times 400\pi\right]$$

$$= \frac{\pi}{20}\left[4625\right] = \frac{925\pi}{4}$$

$$= 726.5\,cm^3$$

Exercise 1D

1) $E(Y) = 2 \qquad Var(Y) = 32$

$Y = 4X - 6$

a) $E(Y) = 4E(X) - 6$

$\frac{E(Y)+6}{4} = E(X)$

$E(X) = \frac{2+6}{4} = 2$

b) $Var(Y) = 4^2 Var(X)$

$\frac{Var(Y)}{16} = Var(X)$

$Var(X) = \frac{32}{16} = 2$

c) $Var(X) = 2$

$X_{sd} = \sqrt{2}$

3)

y	5	7	9	11
x	1	2	3	4
$P(X=x)$	0.3	a	b	0.2

Given $E(Y) = 8$

$$0.3 + a + b + 0.2 = 1$$

$$\Rightarrow \underline{a + b = 0.5} \quad (1)$$

$$E(Y) = 0.3 \times 5 + a \times 7 + b \times 9 + 0.2 \times 11 = 8$$

$$7a + 9b = 4.3 \quad (2)$$

By Calc $\quad a = \frac{1}{10}, \; b = \frac{4}{10}$

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5)

y	1	0	1	4	9
x	-2	-1	0	1	2
$P(X=x)$	a	b	c	b	a

$Y = (X+1)^2$

Given $\quad E(Y) = 2.4 \qquad P(Y > 2) = 0.4$

$$\sum_x P(X=x) = 1 \Rightarrow a + b + c + b + a = 1$$

$$\Rightarrow 2a + 2b + c = 1$$

$$E(Y) = a + 0 + c + 4b + 9a = 2.4$$

$$\underline{10a + 4b + c = 2.4}$$

$P(Y > 2) = b + a = 0.4$

By calc $\quad a = \frac{1}{10}, \quad b = \frac{3}{10}, \quad c = \frac{2}{10}$

$P(2X + 3 \leq Y)$

y	1 ✓	0	1	4	9 ✓
x	-2	-1	0	1	2
$2x+3$	-1	1	3	5	7
$P(X=x)$	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{1}{10}$

$P(2x+3) \leq Y = \frac{1}{10} + \frac{1}{10} = \frac{1}{5}$

Classwork and Homework

Ex 1C even numbers

Ex 1D even numbers