1. (a) The random variable X has a Normal distribution with mean 3 and variance 16. Find $P(X > 2)$.

   (b) The random variable Y has a Normal distribution with mean 2 and variance 1. X and Y are independent. Find the distribution of $W = X3Y$, and find $P(W > 0)$.

   (c) The independent random variables Y_1, Y_2 and Y_3 have the same distribution as Y, and the random variable V is defined as $XY_1Y_2Y_3$. Find $P(V > 0)$.

   (d) The independent random variables $X_1, X_2, \ldots, X_n$ have the same distribution as X. Write down in terms of n the distribution of the mean

   $$\bar{X} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{n}$$

   and find the least value of n such that $P(\bar{X} > 0) > 0.9995$.

2. Let X and Y be independent standard Normal random variables and let $\Theta(.)$ denote the cumulative distribution function of a standard Normal random variable.

   (a) Find $P(3X > 4Y + 2)$, and write down $P(X \leq x, Y \leq x)$ in terms of $\Theta(x)$.

   (b) Let $W = max(X, Y)$.

      (i) Explain why the cumulative distribution function of W is given by

      $$F_W(w) = [\Theta(x)]^2$$

      where $-infty \leq w \leq infty$.

      (ii) Find Q1 and Q3, the lower and upper quartiles of W.

   (c) A random sample of 100 observations of W is taken. Write down the distribution of the number N of observations in the sample which lie outside the interval $(Q1, Q3)$. Use a suitable approximation to calculate $P(N \geq 58)$.

3. Let X and Y be independent standard Normal random variables and let $\Theta(.)$ denote the cumulative distribution function of the standard Normal random variable.

   (a) Write down the distribution of $4X3Y$ and hence find $P(4X > 3Y + 2)$.

   (b) Let $W = max(X, Y)$.

      (a) Write down $P(X \leq x, Y \leq x)$ in terms of $\Theta(x)$ and hence explain why the cumulative distribution function of W is given by

      $$F_W(w) = [\Theta(x)]^2$$

      where $-infty \leq w \leq infty$.

      (b) Find Q1 and Q3, the lower and upper quartiles of W.

   (c) A random sample of 400 observations of W is taken. Write down the distribution of the number K of observations in the sample that lie within the interval $(Q1, Q3)$. Use a suitable approximation to calculate $P(K \leq 210)$.