

1(a)	$s^2 = \frac{1}{9} \left('71314' - \frac{'844'^2}{10} \right) \quad \left[= \frac{134}{15} = 8.933 \right]$
	2.262
	$\frac{'844'}{10} \pm '2.262' \sqrt{\frac{'8.933'}{10}}$
	[82.3, 86.5]
	The distribution of estimates of angles is normal. OR The estimates are a random sample from some population. OR The estimates are independent. OR Underlying distribution is normal.
1(b)	Population unlikely to be normal as θ is close to right-angle / data is skewed. OR Estimates may not be independent, for example due to collusion. OR No indication that sample is random.

2(a)	$p = \frac{e^{-2.8}(2.8)^3}{3!} \times 100 = 22.248$
	$q = \frac{(29 - 22.25)^2}{22.25} = 2.05$
2(b)	H_0: Po(2.8) fits the data. H_1: Po(2.8) does not fit the data. OR H_0: Po(2.8) is a satisfactory model for the number of cars (entering the car park). H_1: Po(2.8) is not a satisfactory model for the number of cars (entering the car park).
	$2.739 + 0.241 + 2.152 + '2.049' + 0.425 + 3.753 + 0.037 \quad [=11.396]$
	'11.4' < 12.59, accept H_0 / do not reject H_0 / not significant.
	Insufficient evidence to suggest that Po(2.8) is not a good fit to the data. OR Insufficient evidence to suggest that the manager's claim is false.

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$$\frac{1}{4} \times 28 \times (28 + 1) \quad [= 203]$$

$$\frac{1}{24} \times 28 \times (28 + 1) \times (56 + 1) \quad [= 1928.5]$$

$$[z =] \frac{T + 0.5 - '203'}{\sqrt{'1928.5'}}$$

$$\frac{T + 0.5 - '203'}{\sqrt{'1928.5'}} > -2.576$$

$$T > 89.4$$

$$T = 90$$

5(a)	$\frac{1}{16} \left[\frac{2}{3} x^{\frac{3}{2}} \right]_0^4 + \frac{1}{k} \left[2\sqrt{x} \right]_4^9 = 1$ $\frac{1}{24}(8-0) + \frac{2}{k}(3-2) = 1$ OR $\frac{1}{3} + \frac{2}{k} = 1$
	$\frac{2}{k} = \frac{2}{3}, k = 3$
5(b)	$\frac{1}{16} \int_0^4 \sqrt{x} \, dx + \frac{1}{3} \int_4^m x^{-\frac{1}{2}} \, dx = \frac{1}{2}$ OR $\frac{1}{3} \int_m^9 x^{-\frac{1}{2}} \, dx = 0.5$
	$\frac{1}{3} + \frac{2}{3}(\sqrt{m} - 2) = \frac{1}{2}$ OR $\frac{2}{3}(3 - \sqrt{m}) = \frac{1}{2}$
	$m = \frac{81}{16} \quad [= 5.0625]$

5(c)

$$F(x) = \begin{cases} \frac{1}{24}x^{\frac{3}{2}} & 0 \leq x < 4 \\ \frac{2}{3}x^{\frac{1}{2}} - 1 & 4 \leq x \leq 9 \end{cases}$$

$$G(y) = \begin{cases} \frac{1}{24}y^3 & 0 \leq y < 2 \\ \frac{2}{3}y - 1 & 2 \leq y \leq 3 \end{cases}$$

$$g(y) = \begin{cases} \frac{1}{8}y^2 & 0 \leq y < 2 \\ \frac{2}{3} & 2 \leq y \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

Alternative method for question 5(c)

Using chain rule (or inverse function):

$$G(y) = F(y^2) \text{ so } g(y) = \frac{d}{dy} F(y^2) = 2yf(y^2).$$

$$g(y) = \begin{cases} 2y\left(\frac{1}{16}\sqrt{y^2}\right) & 0 \leq y < 2 \\ 2y\left(\frac{1}{3\sqrt{y^2}}\right) & 2 \leq y \leq 3 \end{cases}$$

$$g(y) = \begin{cases} \frac{1}{8}y^2 & 0 \leq y < 2 \\ \frac{2}{3} & 2 \leq y \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

7(a)	$G_X(t) = a + 2at + bt^2$
	$G'_X(t) = 2a + 2bt$ $E(X) = G'_X(1) = 2a + 2b$
7(b)	$G''_X(t) = 2b$
	$\text{Var}(X) = 2b + (2a + 2b) - (2a + 2b)^2$
	$2b + (2a + 2b) - (2a + 2b)^2 = 2b + (2a + 2b)(1 - (2a + 2b))$ $= 2b + 2(a + b)(1 - 2a - 2b)$
	Alternative method for question 7(b)
	$E(X^2) = 0^2 \times a + 1^2 \times 2a + 2^2 \times b = 2a + 4b$
	$\text{Var}(X) = (2a + 4b) - (2a + 2b)^2$
	$(2a + 4b) - (2a + 2b)^2 = 2b + 2a + 2b - (2a + 2b)^2$ $= 2b + (2a + 2b)(1 - (2a + 2b))$ $= 2b + 2(a + b)(1 - 2a - 2b)$

7(c)	$G_Y(t) = (a + 2at + bt^2)^{10}$
	$G_Y'(t) = 20(a + bt)(a + 2at + bt^2)^9$ $E(Y) = 20(a + b)(3a + b)^9$
	$3a + b = 1$, hence $E(Y) = 20(a + b) = 10E(X)$.
7(d)	Binomial
	$B\left(10, \frac{2}{3}\right)$