



**SAMPLE MIDTERM TEST
SELECTED FINAL ANSWERS**

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QUESTION 1 (3 POINTS)

$p^3 + p^5 - p^8$, where $p = 1 - q$.

QUESTION 2 (3 POINTS)

$\mathcal{P}(\text{have the disease} \mid \text{test was positive}) = \frac{1000}{5995} = \frac{200}{1199}$.

QUESTION 3 (7 POINTS)

(d) $\mathcal{E}\{\mathbf{Y}\} = 7$, and variance of \mathbf{Y} is 45.

(e) (i) $\mathcal{P}(\mathbf{X} \geq 1) = \frac{1}{2}$; (ii) $\mathcal{P}(\mathbf{X} < 0) = Q(\frac{1}{2}) \simeq 0.3085$, and (iii) $\mathcal{P}(|\mathbf{X}| > 4) = Q(\frac{3}{2}) + Q(\frac{5}{2}) \simeq 0.07302$.

QUESTION 4 (5 POINTS)

(a) $c = 3$. (b) $\mathcal{P}(\mathbf{X} \geq x + a) = e^{-3(x+a)}$. (c) $\mathcal{P}(\mathbf{X} \geq x + a \mid \mathbf{X} \geq a) = e^{-3x}$.

QUESTION 5 (3 POINTS)

(a) Probability of a no defect chip is $e^{-1} \simeq 0.368$; cost is $\$10/e^{-1} \simeq \27.18 .

(b) Probability of a functioning chip is $2.1 \times e^{-1.1} \simeq 0.699$; cost is $\simeq \$17.17$.

QUESTION 6 (5 POINTS)

(a) (i) $F_{\mathbf{X}}(x) = \begin{cases} 1, & \text{if } x \geq 2; \\ \frac{1}{7}(x^3 - 1), & \text{if } 1 < x < 2; \\ 0, & \text{otherwise.} \end{cases}$ (ii) $\mathcal{E}\{\mathbf{X}\} = \frac{45}{28}$; (iii) $\text{var}(\mathbf{X}) = \frac{93}{35} - \left(\frac{45}{28}\right)^2 = \frac{291}{3920}$.

(b) $f_{\mathbf{Y}}(y) = \begin{cases} \frac{1}{7}, & 2 < y < 9; \\ 0, & \text{otherwise.} \end{cases}$