IB Math HL 2 **Ch 25 Big Idea: Can you use _____to evaluate _____outcomes? A:_____**

Chapter 25 Quiz Practice

1. Review Sets 25A (1 – 3, 5); 25B (6 – 13)

2. Six customers wait in a queue in a supermarket. A customer can choose to pay with cash or a credit card. Assume that whether or not a customer pays with a credit card is independent of any other customer's method of payment. It is known that 60% of customers choose to pay with a credit card.

a. Find the probability that: i. the first three customers pay with a credit card and the next three pay with cash.
ii. exactly three of the six customers pay with a credit card.

b. There are n customers waiting in another queue in the same supermarket. The probability that at least one customer pays with cash is greater than 0.995. Find the minimum value of n.

3. A ferry carries cars across a river. There is a fixed time of T minutes between crossings. The arrival of cars at the crossing can be assumed to follow a Poisson distribution with a mean of one car every four minutes. Let X denote the number of cars that arrive in T minutes. Find T, to the nearest minute, if $P(X \le 3) = 0.6$

4. Casualties arrive at an accident unit with a mean rate of one every 10 minutes. Assume that the number of arrivals can be modeled by a Poisson distribution.

a. Find the probability that there are no arrivals in a given half hour period.

b. A nurse works for a two hour period. Find the probability that there are fewer than ten casualties during this period.

c. Calculate the time interval during which there is a 95% chance of there being at least two casualties.

d. Six nurses work consecutive two hour periods between 8 am and 8 pm. Find the probability that at least three nurses will attend to less than ten casualties.

Chapter 25 Quiz Practice Just Answers

2ai. 0.0138 ii. 0.276
b. 11

3. 13 minutes

4a. 0.0498
b. 0.242
c. 47.4 minutes
d. 0.157

Worked solutions are on next page. See if you can figure it out without looking.

Chapter 25 Quiz Practice Solutions

2a. i. $(0.6)^3 \cdot (0.4)^3 = 0.0138$ ii. ${}_6C_3(0.6)^3(0.4)^3 = 0.276$

b. P(at least one pays cash) > 0.995 → P(no one pays cash) < 0.005

$(0.6)^n < 0.005$ solve inequality by any method (graph, logs) → n = 11 is minimum value for n.

3. (2013 P2 TZ1 #10)

(a) $X \sim \text{Po}(0.25T)$ *(A1)*

Attempt to solve $P(X \le 3) = 0.6$ *(M1)*

$T = 12.8453\ldots = 13$ (minutes) *A1*

Note: Award *A1M1A0* if T found correctly but not stated to the nearest minute.

[3 marks]

4. 1 accident every 10 min.

a. 3 accidents in 30 min $X \sim Po(3)$

$m = 3$ P(no accidents arrive)

$P(X=0) = \text{poissonpdf}(3,0)$

$\approx \boxed{0.0498}$

b. two hours: 12 accidents in 120 min

$Y \sim P_o(12)$ $P(Y < 10) = \text{poissoncdf}(12, 9)$

$\approx \boxed{0.242}$

d. 6 nurses work two hours each

For one nurse $P(Y<10) \approx 0.242$

6 trials → $Z \sim B(6, 0.242)$ ← Z = # of nurses w/ less than 10 accidents

$P(Z \ge 3) = \text{binomcdf}(6, .242, 3, 6)$

$\approx \boxed{0.157}$

c. $W \sim P_o(k)$

$\frac{1}{10} = \frac{4.74386}{T}$

$T = \boxed{47.4 \text{ minutes}}$

$P(X \ge 2) = .95$

$P(X < 2) = 0.05$

$P(0) + P(1) = 0.05$

$\frac{k^0 e^{-1}}{0!} + \frac{k^1 e^{-1}}{1!} = .05$

$k = 4.74386$