Topic Test: Applications of Probability

Remember: these are HSC-type questions.

Time allowed: 40 minutes **Total marks:** 25

Part A (Suggested time: 15 minutes)

Choose the correct answer (A, B, C or D) for each question. One mark each

1 If a die was thrown twelve times, how many times would you expect to get 4?

A 2 B 3
C 4 D 6

2 What is Julie's financial expectation if she has a 30% chance of gaining $3000, a 10% chance of gaining $5000, but otherwise she loses $2000?

A −$600 B −$200
C $200 D $600

3 A two-way table has been drawn up to show the results of a survey of workers, whether they were late for work and how they travelled to work.

	On Time	Late
Private transport	75	15
Public transport	360	105

What is the probability that a person who is late travelled by private transport?

A $\frac{1}{5}$ B $\frac{1}{6}$ C $\frac{1}{7}$ D $\frac{1}{8}$

4 Referring to the two-way table in question 4, what is the probability that a person travelling by public transport is late?

A $\frac{7}{24}$ B $\frac{7}{29}$ C $\frac{7}{31}$ D $\frac{7}{37}$

5 Sally expected to score 'five' four times when she spun a spinner twenty times. What is the probability of scoring 'five'?

A $\frac{1}{4}$ B $\frac{1}{5}$ C $\frac{4}{5}$ D $\frac{3}{20}$

6 What is the financial expectation if you have three chances in five of gaining $1200?

A $450 B $480
C $720 D $750

7 The probability of winning a particular game is $\frac{3}{8}$. Mickey won nine games in one day but he would have been expected to win twelve. How many games did Mickey play?

A 8 B 24
C 32 D 56

8 Which could be used to simulate the results when three names are arranged in order on a ballot paper?

A tossing two coins
B tossing three coins
C throwing a die
D drawing a card from a pack and noting the value

9 Kelly bought a ticket for $20 in a raffle in which 100 tickets were sold. Two tickets are drawn, one after the other without replacement, for the first and second prizes. First prize is worth $1000 and second prize $500. What is Kelly's financial expectation?

A −$5 B −$4.60
C $14.60 D $15

10 A group of 36 people are each asked to choose a positive whole number less than ten. How many would you expect to choose an even number?

A 18 B 16
C 14 D 12

Part B (Suggested time: 25 minutes)

Show all working. **15 marks**

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11 A two-way table has been drawn up to show the results of testing a new diagnostic tool for a particular disease.

	Accurate	Inaccurate
Positive	63	7
Negative	429	34

a How many of those tested did not have the disease? 1 mark

b What is the probability that a positive test was accurate? 1 mark

c What is the probability that a person tested had the disease? 2 marks

12 Heidi is considering playing a game in which the probability of winning is 8%. It costs $10 to play the game and there is one prize of $120.

a What is Heidi's financial expectation if she plays the game? 1 mark

b Would you recommend that Heidi play the game? Justify your answer. 1 mark

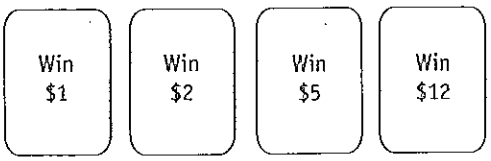
13 Two dice are thrown together. The numbers on the uppermost faces are added together to form the score.

a Draw up a table to show the possible outcomes. 1 mark

b If the dice were thrown together a number of times, would you expect to score more 6's or 8's? Justify your answer. 2 marks

c Ken threw the dice together eighteen times. He scored a nine only once. Is this what you would expect? Comment. 2 marks

14 Peggy plays a game in which she chooses one of four cards.



a What is Peggy's financial expectation? 1 mark

b Explain why removing the 'win $5' card does not change the financial expectation. 1 mark

c By how much would the financial expectation improve if, instead, the 'win $2' card was removed? 1 mark

d In the original game, what would the financial expectation be if it cost $6 to play? 1 mark

Go to p 291 for **Quick Answers**
or to pp 350–1 for **Worked Solutions**

Solutions

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1 $P(\text{four}) = \frac{1}{6}$

Expected number $= \frac{1}{6} \times 12$
$= 2$ A

2 Financial expectation
$= 30\% \times \$3000 + 10\% \times \$5000 - 60\% \times \$2000$
$= \$200$ C

3 Number late $= 15 + 105$
$= 120$

$P(\text{private transport}) = \frac{15}{120}$
$= \frac{1}{8}$ D

4 Public transport $= 360 + 105$
$= 465$

$P(\text{late}) = \frac{105}{465}$
$= \frac{7}{31}$ C

5 Expected number $= 4$
$P(\text{scoring five}) \times 20 = 4$

$P(\text{scoring five}) = \frac{4}{20}$
$= \frac{1}{5}$ B

6 Financial expectation $= \frac{3}{5} \times \$1200$
$= \$720$ C

7 Expected number $= 12$
$\frac{3}{8} \times$ number of games played $= 12$

number of games played $= 12 \div \frac{3}{8}$
$= 32$ C

8 Number of arrangements $= 3 \times 2 \times 1$
$= 6$

$P(\text{any arrangement}) = \frac{1}{6}$
Only throwing a die gives outcomes with probability $\frac{1}{6}$. C

9 Financial expectation
$= \frac{1}{100} \times \$1000 + \frac{1}{100} \times \$500 - \$20$
$= -\$5$ A

10 Even numbers are 2, 4, 6 and 8.
$P(\text{even number}) = \frac{4}{9}$
Expected number $= \frac{4}{9} \times 36$
$= 16$ B

11

	Accurate	Inaccurate
Positive	63	7
Negative	429	34

a Number without disease $= 7 + 429$
$= 436$ ✓

b Positive tests $= 63 + 7$
$= 70$

$P(\text{positive test is accurate}) = \frac{63}{70}$
$= \frac{9}{10}$ ✓

c Number tested $= 436 + 63 + 34$
$= 533$
Number with disease $= 63 + 34$
$= 97$ ✓

$P(\text{having disease}) = \frac{97}{533}$ ✓

12 a Financial expectation
$= 8\%$ of $\$120 - \$10$
$= 0.08 \times \$120 - \$10$
$= -\$0.40$ ✓

b Heidi should not play the game because she can expect to lose money; the financial expectation is negative. As it is only small Heidi might be happy to risk losing the money in the hope of gaining \$120. ✓

13 a

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

✓

b $P(\text{scoring 6}) = \frac{5}{36}$
$P(\text{scoring 8}) = \frac{5}{36}$ ✓

The probability of scoring 8 is the same as the probability of scoring 6 so you would expect to get the same number of 6's and 8's. ✓

c $P(\text{scoring 9}) = \frac{4}{36}$
$= \frac{1}{9}$

Expected number $= \frac{1}{9} \times 18$
$= 2$ ✓

You would expect to score 9 twice in eighteen tosses. Ken's result is only one less than the expected number. ✓

14 a Financial expectation
$= \frac{1}{4} \times \$1 + \frac{1}{4} \times \$2 + \frac{1}{4} \times \$5 + \frac{1}{4} \times \$12$
$= \$5$
Peggy's financial expectation is \$5. ✓

b If one card is removed, three remain.
New financial expectation
$= \frac{1}{3} \times \$1 + \frac{1}{3} \times \$2 + \frac{1}{3} \times \$12$
$= \$5$
Because the amount removed is the same as the financial expectation, the expectation does not change. ✓

c If 'Win \$2' is removed:
New financial expectation
$= \frac{1}{3} \times \$1 + \frac{1}{3} \times \$5 + \frac{1}{3} \times \$12$
$= \$6$
The financial expectation would improve by \$1. ✓

d If the cost is \$6.
Financial expectation $= \$5 - \$6$
$= -\$1$ ✓