5.4 Experimental Probability and Relative Frequency: Test Pack

Calculators not allowed · about 55 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A fair coin is tossed once. Write down the probability that it lands heads.

(1)

2 A die is rolled 30 times. The recorded counts for faces 1 to 6 are: 6, 4, 9, 3, 5, 3. Which face deviates most from the expected frequency and by how many rolls?

(3)

3 Design a simple experiment to test whether a coin is fair. Give the main steps you would take and explain briefly what result would suggest the coin is fair.

(4)

4 The probability that a seed grows into a plant is 1/10. Sam plants 300 seeds. How many plants should he expect?

(2)

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5 A bag contains 5 red counters and 3 blue counters. A counter is chosen at random. Give the probability the counter is blue.

(1)

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6 The probability that it rains on a given day is 4/5. Estimate the number of days with rain in a period of 50 days.

(2)

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7 Lily spins a spinner 100 times and it lands on blue 31 times. Work out the relative frequency of blue. Give your answer as a fraction in its simplest form.

(1)

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8 A die is rolled 60 times and a 6 appears 11 times. If the die is fair, a 6 should appear about 10 times. Does the data suggest that the die is biased? Give a reason.

(2)

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9 In an experiment a drawing pin is dropped 80 times and lands point up 44 times. Use this to estimate how many times it will land point up in 200 drops.

(3)

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10 A fair six-sided die is rolled 60 times. Using expected frequency, how many times would you expect to roll a number less than 4 (that is 1, 2 or 3)?

(2)

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11 A charity raffle uses a spinner with 12 equal sections to select a jackpot section. In a trial of 300 spins, the jackpot section comes up 30 times. Calculate the relative frequency of landing on the jackpot section, state the theoretical probability of landing on the jackpot section, and say whether the spinner landed on the jackpot section more or less often than expected in this trial.

(3)

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12 A school bus arrives late on 6 out of 40 days in a trial period. Use this data to estimate the probability that the bus is late on a randomly chosen day, and use your estimate to predict the number of late days out of the next 30 days.

(3)

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13 A gardener plants sunflower seeds. In a trial, 34 out of 40 seeds germinate. Using this experiment as an estimate, find the probability that a seed fails to germinate, then predict how many seeds out of 500 would fail to germinate.

(3)

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14 A weather station records that it rained on 8 out of the past 25 days.

(a) Find the experimental probability of rain on a given day, giving your answer as a fraction in simplest form. **(2)**

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(b) A forecaster claims the chance of rain in this season is 1/4. Compare the experimental probability to the forecaster's claim and state, with a reason, whether the data suggests the true chance is higher or lower than the claim. **(2)**

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15 A theme park ride sometimes breaks down. Over a season, engineers recorded the ride running normally on 180 out of 200 opening days. Calculate the relative frequency that the ride runs normally on a given day, giving your answer as a decimal. Use this to estimate the number of days the ride would run normally over the next 400 opening days.

(4)

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16 A dice is rolled 40 times. The number 3 appears 5 times. Find the relative frequency of rolling a 3, giving your answer as a fraction in simplest form.

(1)

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17 A bag contains 3 green counters and 7 yellow counters. A counter is picked at random, its colour is noted, then it is replaced. This is repeated 60 times. Find the expected number of green picks.

(1)

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18 A coin is tossed 80 times and lands on heads 47 times. Calculate the relative frequency of heads as a decimal, and state whether the coin appears biased towards heads compared to a fair coin.

(2)

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19 A dice is rolled 90 times. The number 2 appears 20 times. Calculate the relative frequency of rolling a 2, giving your answer as a fraction in simplest form.

(2)

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Mark scheme · 5.4 Experimental Probability and Relative Frequency: Test Pack

Question 1

1/2 or 0.5 or 50% cao	B1

Answer: **1/2**

Question 2

expected frequency shown as 30/6 = 5	M1
deviations calculated: |6-5|, |4-5|, |9-5|, |3-5|, |5-5|, |3-5|	M1
face 3 deviates most by 4 rolls cao	A1

Answer: **Face 3 by 4**

Question 3

suggest carrying out a large number of tosses, e.g. at least 50 or 100	M1
state recording outcomes and calculating relative frequency of heads	M1
state comparing relative frequency to theoretical probability 0.5	M1
conclude that a result close to 0.5 after many trials suggests the coin is fair cao	A1

Answer: **Do at least 50 to 100 tosses, record and calculate relative frequency of heads, compare to 0.5; a result close to 0.5 suggests the coin is fair**

Question 4

1/10 x 300	M1
30 cao	A1

Answer: **30**

Question 5

3/8 cao	B1

Answer: **3/8**

Question 6

4/5 x 50	M1
40 cao	A1

Answer: **40**

Question 7

31/100 cao	B1

Answer: **31/100**

Question 8

relative frequency 11/60 = 11/60 compared with 1/6, oe (accept 11 compared with the expected 10)	M1
The relative frequency is close to 1/6, so there is no evidence that the die is biased	A1

Answer: **The relative frequency is close to 1/6, so there is no evidence that the die is biased**

Question 9

relative frequency 11/20	M1
11/20 x 200	M1
110 cao	A1

Answer: **110**

Question 10

method: probability 3/6 = 1/2 then expected frequency 1/2 of 60	M1
30 cao	A1

Answer: **30**

Question 11

relative frequency = 30/300 = 1/10 (0.1) oe	M1
theoretical probability stated as 1/12 (about 0.083) oe	M1
0.1 is greater than 1/12, so the jackpot section came up more often than expected cao	A1

Answer: **Relative frequency 1/10 (0.1); theoretical 1/12 (about 0.083); more often than expected**

Question 12

relative frequency = 6/40 = 0.15 oe	M1
method: 30 x 0.15	M1
4.5 cao (accept 4 or 5 days)	A1

Answer: **4.5 (accept 4 or 5 days)**

Question 13

P(germinate) = 34/40 = 0.85, so P(fail) = 1 - 0.85 = 0.15	M1
method: 500 x 0.15	M1
75 cao	A1

Answer: **75**

Question 14

(a) 8/25 shown	M1
(a) 8/25 cao (already in simplest form)	A1

(a) Answer: **8/25**

(b) converts to compare, e.g. 8/25 = 0.32 and 1/4 = 0.25, or cross-multiplies 8x4=32 and 1x25=25	M1
(b) 0.32 is greater than 0.25, so the data suggests the true chance of rain is higher than the forecaster's claim cao	A1

(b) Answer: **Data suggests the chance of rain is higher than claimed (0.32 > 0.25)**

Question 15

relative frequency = 180/200 shown	M1
0.9 cao	A1
method: 400 x 0.9	M1
360 cao	A1

Answer: **0.9; 360 days**

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Question 16

1/8 cao	**B1**

Answer: **1/8**

Question 17

18 cao	**B1**

Answer: **18**

Question 18

relative frequency = 47/80 = 0.5875 shown	**M1**
0.5875 is greater than 0.5, so the coin appears slightly biased towards heads cao	**A1**

Answer: **0.5875; slightly biased towards heads**

Question 19

20/90 shown	**M1**
2/9 cao	**A1**

Answer: **2/9**

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