IB · DP · Maths

🕐 1 hour   ❓ 5 questions

Practice Paper 2

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Total Marks   **/80**

1 (a) A laboratory is testing the effectiveness of a new indicator for the presence of a particular mineral in water. This mineral occurs naturally in approximately 8% of water sources.

The laboratory collected samples of water from several sources in the country. The country has been divided into different areas based on their geology and the number of samples taken from each area is proportional to the size of the area.

State the sampling method being used.

(1 mark)

(b) It is intended that if the mineral is present in the water sample the test result will be "positive" and if the mineral is not present in the sample the test result will be "negative".

There is a certain amount of unreliability in the results of the test. 4% of samples that have the mineral present test negative. 89% of the samples that **do not** have the mineral present test negative.

The tree diagram shows some of this information.
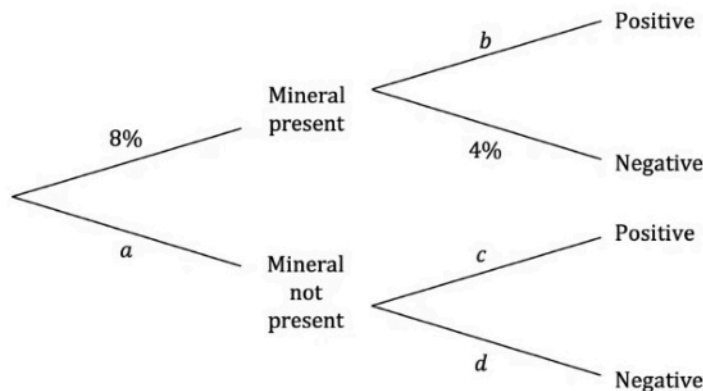
Write down the value of

i) a

ii) b

iii) c

iv) d.

(4 marks)

(c) Use the tree diagram to find the probability that a water sample selected at random

   i)   will not have the mineral present and will test negative,

   ii)   will test positive,

   iii)   will have the mineral given that it tested positive.

(8 marks)

(d) The scientists from the laboratory collected additional information about each sample: if the sample was taken from an area where livestock was present (L), if the sample was within 100 miles of the laboratory (D) and if the sample was tested in the laboratory within 24 hours of being collected (T).

   • 39 samples were taken from an area with livestock;

- 33 samples were taken within 100 miles of the laboratory;
- 36 samples were tested in the laboratory within 24 hours of being collected;
- 5 samples were taken from an area with livestock, within 100 miles of the laboratory and tested within 24 hours;
- 2 samples were taken from an area with livestock and within 100 miles of the laboratory but were not tested within 24 hours;
- 11 samples were taken within 100 miles of the laboratory and tested within 24 hours but were not taken from an area with livestock;
- 12 samples were tested within 24 hours but were not from an area with livestock nor were they taken from an area within 100 miles of the laboratory;
- 3 samples were taken from an area more than 100 miles from the laboratory without livestock and they were not tested within 24 hours of being collected.

Draw a Venn diagram to represent this information making sure that the diagram is labelled with all relevant information.
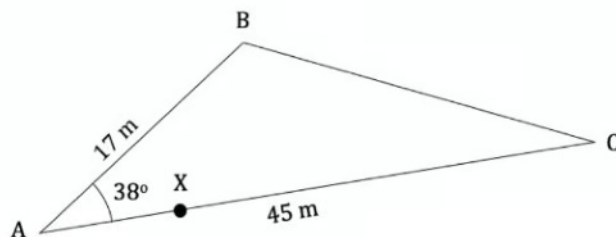
(3 marks)

(e) Find the total number of water samples that were tested by the laboratory.

(2 marks)

2 (a) The diagram below shows a triangular field on a farm. $AB = 17$ m, $AC = 45$ m and angle $\widehat{BAC} = 38°$.

X is a point on AC, such that $AX : XC$ is $1 : 4$.

The field is going to be used for livestock, so a fence is to be installed around its perimeter.

Calculate the total length of fencing required.

(4 marks)

(b) The owner of the field had estimated the length of fence required to be 98 m.

Calculate the percentage error in her estimation.

(2 marks)

(c) The field is to be divided into two parts by installing a new fence connecting B to X.

Calculate the area of BXC.

(d) The farmer decides that field ABX is too small and wishes instead to divide the original field by adjusting the position of X such that angle $\text{A}\widehat{\text{B}}\text{X} = 32°$.

Determine how much less fencing is required for BX given the new position of X.

(6 marks)

3 (a) The number of seats a row has at a comedy festival follows a regular pattern where the first row has u_1 seats and the number of seats in each successive row increases by d seats. In the fourth row there are 25 seats and in the sixteenth row there are 49 seats.

Write down an equation, in terms of u_1 and d, for the number of seats

  i)   in the fourth row

  ii)   in the sixteenth row.

(2 marks)

(b) Find the value of u_1 and the value of d.

(2 marks)

(c) The festival has 18 rows of seats in total.

Calculate the total number of seats.

(3 marks)

(d) The price for a seat in the first row is $22 and the price decreases by 5% each successive row.

  i)   Find the row in which the price of a seat first falls below $10.

  ii)   Find the total revenue the comedy festival generates if 22 tickets are sold for every row. Give your answer rounded to the nearest dollar.

(8 marks)

4 (a) The table below shows the distribution of the number of baskets scored by 150 netball players during a weekly game.

Number of baskets	0	1	2	3	4	5	6
Frequency	41	17	34	31	10	15	2

Calculate

i) the mean number of baskets scored by a player

ii) the standard deviation.

(2 marks)

(b) Find the median number of baskets scored.

(1 mark)

(c) Find the interquartile range.

(2 marks)

(d) Determine if a player who scored 8 baskets would be considered an outlier.

(2 marks)

(e) Two players are randomly chosen.

Given that the first player scored 2 or less baskets, find the probability that both players scored exactly 1 basket.

(4 marks)

(f) The number of hours each player trains each week is normally distributed with a mean of 5 hours and standard deviation of 0.8 hours.

     i)   Calculate the probability that a player trains less than 6 hours a week.

     ii)   Calculate the probability that a player trains less than 4 hours a week.

     iii)   Calculate the expected number of players that train between 4 and 6 hours a week.

(3 marks)

5 (a) Chun-hee is creating some packaging in the shape of a square based pyramid where the base has length x cm and the perpendicular height of the pyramid is h cm. Chun-hee wants to keep the distance from the apex of the pyramid to the midpoint of the base edge fixed at 7 cm.

Write down an equation for the volume, V, of the packaging in terms of x and h.

(1 mark)

(b) Show that V can be expressed by $\dfrac{196}{3}h - \dfrac{4}{3}h^3$.

(3 marks)

(c) Find $\dfrac{dV}{dh}$.

(2 marks)

(d) Find the value of h for which the volume of the pyramid is maximised.

(2 marks)

(e) Find the value of x when the volume of the pyramid is maximised.

(f) Chun-hee decides to make the packaging using the dimensions required to maximise the volume. The material for the packaging costs 4 KRW / cm2

Calculate the number of units that Chun-hee can make given that she has 90, 000 KRW.

(4 marks)

(g) Chun-hee takes out a 3 year loan for 90,000 KRW at a nominal annual interest rate of 2.3% compounded monthly. Repayments are made at the end of each month.

Find the value of the repayments that Chun-hee must make to pay off the loan.

(3 marks)