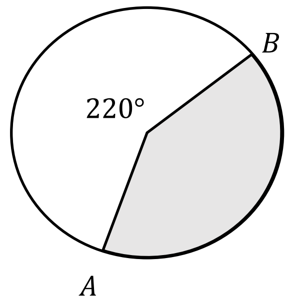
Mathematics: Applications and Interpretations SL

Paper 1.

1. The radius of a circle is 4 m. It is divided into two parts as shown:



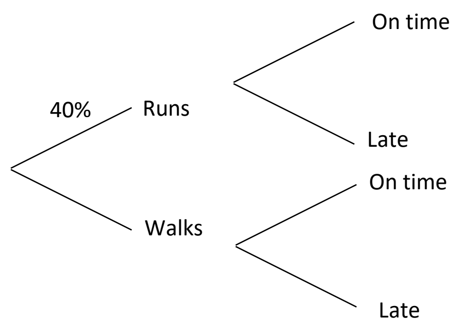
Determine:

a) The area of the non-shaded portion. (2)

b) The perimeter of the shaded portion of the circle. (3)

Working and solutions:

2. Jonathan either runs or walks or runs to school. If he runs, the probability he is late for school is 20%. If he walks, this probability increases to 60%.



a) Complete the tree diagram (2)

b) Calculate the probability he is on time for school (2)

c) Given that he is on time for school, work out the probability he walked. (3)

Working and solutions:

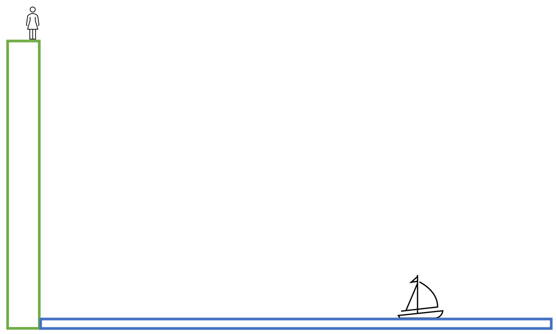
3. The mass of chocolate bars is normally distributed with a mean of 50 grams, and a standard deviation of 2.5 grams.

   a) Determine the probability that a randomly chosen chocolate bar will have a mass between 48 and 54 grams. (2)

   b) It has been determined that 75% of chocolate bars have a mass greater than M. Determine the value of M. (2)

Working and solutions:

4. Maria is standing at the top of a cliff, at the very edge, pointing to a boat. It is known that she is 120 m above the base of the cliff, and that the angle of depression is 42 degrees. This information is illustrated in the schematic:



a) Draw the angle of depression on the diagram by adding appropriate lines. (1)
b) Work out the distance of the boat from the bottom of the cliff. (2)
c) State one assumption made in the question. (1)

Working and solutions:

5. In a game, the probability of drawing a blue ball from a bag is 65%. The ball is draw, the colour is noted, and the ball is put back in the bag.

   a) If the game is played 20 times, work out the expected number of times it should be blue. (2)

   b) If the game is played 40 times, determine the probability the ball will be blue exactly half of the time. (2)

   c) If the game is played 10 times, determine the probability the ball will not be blue at least 4 times. (3)

Working and solutions:

6. Elise is going to invest 10 000 CHF. She has two options to chose from

   Option A: She can deposit the entire amount in an account offering 3.4% compound interest per year, compounded annually. Inflation is predicted to be 0.4%.

   Option B: She can deposit 5000 CHF initially, then 1000 each year for 5 years. This account gives her 2.6% compounded half-yearly and is protected from inflation.

   Which option would give her the greatest gain at the end of 5 years? (6)

Working and solutions:

7. A teacher is using two different techniques to teach two separate classes. During teacher training, she was told that Method A should be more effective than Method B.

These are the grades from the two separate classes at the end of the first term:

Method A	10	15	12	18	14	15	16
Method B	11	10	12	15	14	15	10

She decides to carry out a t-test to determine if there is a difference in efficacy of the two methods, at the 5% significance level.

a) State the null and alternative hypotheses (2)

b) Calculate the t and p-values (2)

c) Make a conclusion concerning the teaching methods (2)

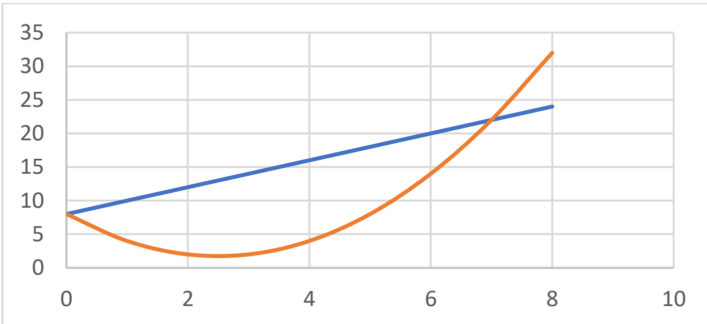
d) State two mathematical assumptions she made, concerning her data. (2)

Working and solutions:

8. We have two functions:

$f(x) = 2x + 8$

$g(x) = x^2 - 5x + 8$



Determine the area **enclosed** by the two functions using technology. (7)

Working and solutions:

9. The data for 3 points is as follows:

x	1	4	7
y	10	18	9

This data can be modelled with:

$$y = Ax^2 + Bx + C$$

Work out the values of A, B and C by setting up and solving 3 simultaneous equations. (7)

Working and solutions:

10. It is known that the time taken for a house to be painted (T), is indirectly proportional to the number of painters (n).

a) Given that it takes 8 painters 6 days to complete the painting of a house, determine the number of days it would take two painters to complete the work. (3)

The general formula for the time taken to paint **a different house** is given as:

$$T = \frac{4}{n}$$

b) Sketch a graph of this for the domain $0 \leq n \leq 20$ (3)

c) State the range of T for this domain. (2)

d) Briefly explain why it is not useful to extend the domain to 1000. (1)

Working and solutions:

11. The velocity of an object is given as $v(t) = 2t + 5$, where t is measured in seconds and distance is measured in m.

a) Given that the distance an object travels away from A, $d(t)$, is the integral of the velocity function, and that the object is initially 20 metres from the starting position, find $d(t)$. (3)

b) Determine the distance the object is from the starting point after 5 seconds. (2)

Working and solutions:

12. For the following function, $f(x) = 3x - 3 + \frac{2}{x}$

a) Find $f'(x)$. (2)

b) Solve $f'(x) = 0$. (2)

c) State the meaning of the solution to b). (1)

Working and solutions: