Question 1 **(Suggested maximum time: 10 minutes)**

Pauline flips a fair coin 3 times, and records the outcomes.
She writes *H* for each head and *T* for each tail.

(i) Complete the table below to show all of the possible outcomes.
Two outcomes have already been filled in for you.

H H H	
H H T	

(ii) Find the probability of getting two heads and one tail.

(iii) Jamie says: "You have the same probability of getting three heads as you do of getting two heads and one tail."
Do you agree with Jamie? Give a reason for your answer.

Answer:

Reason:

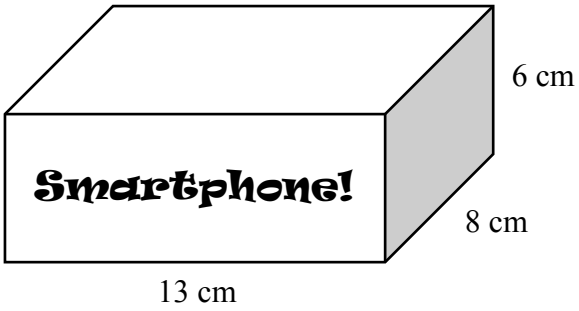
(iv) Max says: "You have the same probability of getting *H H H* as you do of getting *H T H*."
Do you agree with Max? Give a reason for your answer.

Answer:

Reason:

Question 2 **(Suggested maximum time: 15 minutes)**

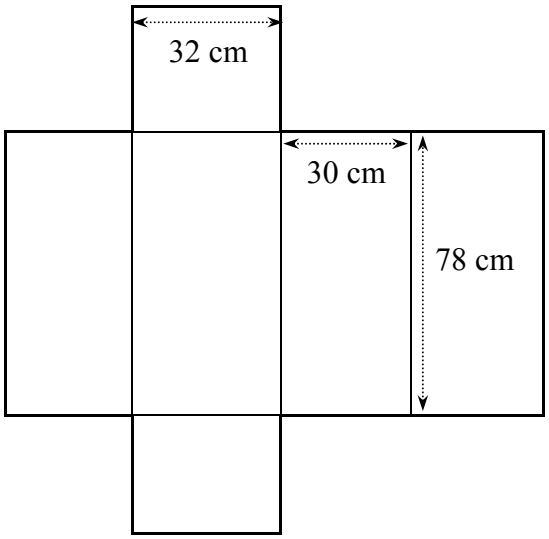
The box for an individual mobile phone is 13 cm long, 8 cm wide, and 6 cm high, as shown.



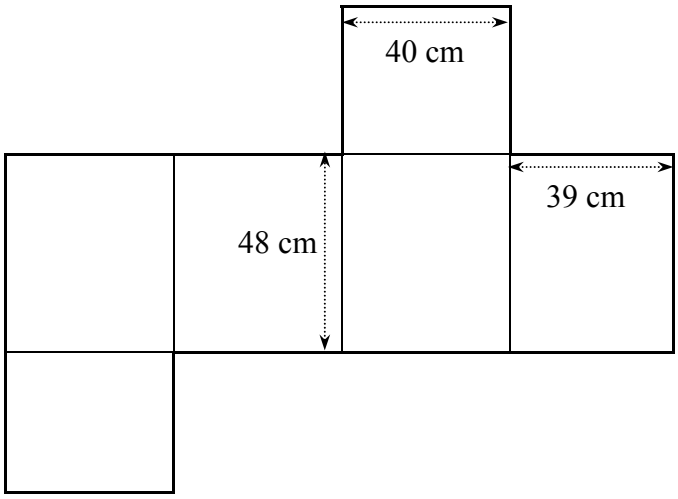
(i) Find the volume of an individual mobile phone box.

These individual mobile phone boxes will be shipped in a large rectangular box.
Below are diagrams of the nets of two large boxes that could be used, Box **A** and Box **B**.

Box **A**



Box **B**



(ii) Show that Box **A** and Box **B** have the same volume.

Box **A**:

Box **B**:

(iii) What is the largest number of individual mobile phone boxes that will fit in each large box?

(iv) Find the surface area of each large box.

Box **A**:

Box **B**:

(v) The large boxes are made from cardboard. The cardboard costs €0·67 per m^2. The cardboard just covers the net of a box. Find the cost of the box that uses the least amount of cardboard.

(vi) An average of 140 large boxes is produced each month. Find the saving, per annum, if you choose to make the box that uses the least amount of cardboard.

Question 3 **(Suggested maximum time: 15 minutes)**

All of the students in a class took *IQ Test 1* on the same day. A week later they all took *IQ Test 2*. Their scores on the two IQ tests are shown in the tables below.

IQ Test 1				
86	104	89	105	96
96	103	94	104	119
115	79	97	111	108

IQ Test 2				
83	120	105	111	114
99	111	108	106	97
97	102	94	108	117

(i) Draw a back-to-back stem-and-leaf plot below to display the students' scores.

IQ Test 1		*IQ Test 2*
	7	
	8	
	9	
	10	
	11	
	12	
Key:		

(ii) Find the range of scores for each IQ test.

IQ Test 1:

IQ Test 2:

(iii) Find the median score for each IQ test.

IQ Test 1:

IQ Test 2:

(iv) Find the mean score for each IQ test.

IQ Test 1:

IQ Test 2:

(v) Compare the scores on the two IQ tests. Refer to **at least one** measure of central tendency and **at least one** measure of variability (spread) in your answer.

(vi) Marshall says that every student in the class must have done better on *IQ Test 2* than on *IQ Test 1*. Is Marshall correct? Explain your answer.

Question 4 **(Suggested maximum time: 20 minutes)**

(a) Prove that the angle at the centre of a circle standing on a given arc is twice the angle at any point of the circle standing on the same arc.

Diagram:

Given:

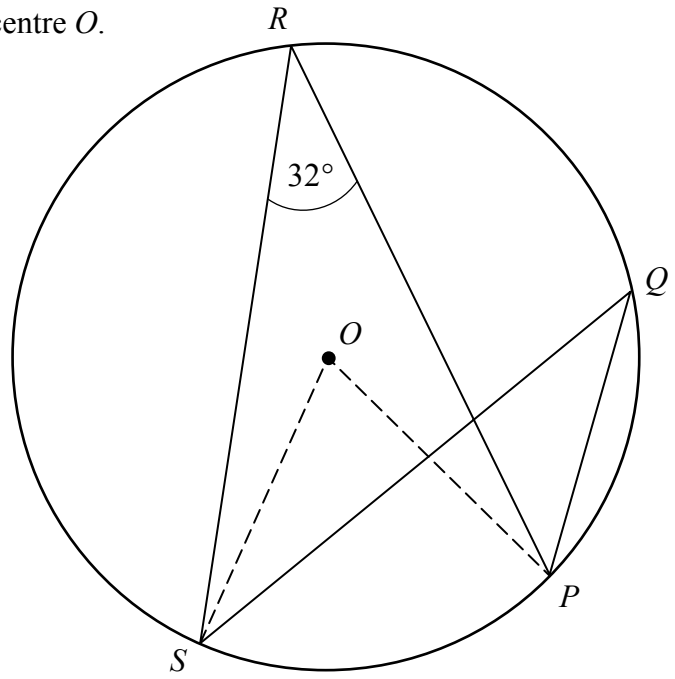
To Prove:

Construction:

Proof:

(b) P, Q, R, and S are points on a circle with centre O.

$|\angle PRS| = 32°$, as shown.

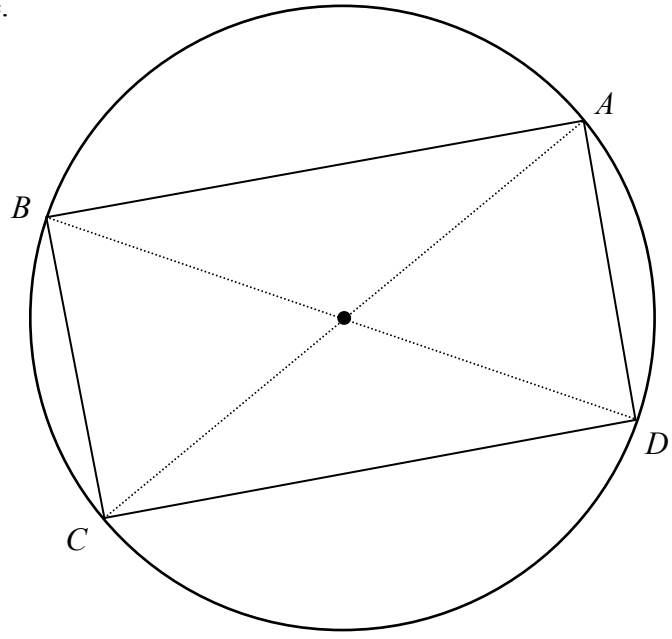


(i) Find $|\angle SOP|$.

(ii) Find $|\angle SQP|$.

(c) A, B, C, and D are points on a circle, as shown below.
$[AC]$ and $[BD]$ are diameters of the circle.

Prove that $ABCD$ is a rectangle.



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Question 5 **(Suggested maximum time: 20 minutes)**

Students in a class are investigating spending in their local area. They each carry out a different survey, and display the results.

(a) John is investigating whether people pay for their weekly shopping with Credit Card, Debit Card, Cash, or Cheque. When people tell him which one of these they usually use, he writes it in a table. His results are shown below.

Credit Card	Debit Card	Debit Card	Cash	Debit Card
Credit Card	Cash	Cash	Credit Card	Debit Card
Debit Card	Debit Card	Cheque	Cash	Cash
Cash	Cash	Debit Card	Cash	Credit Card

(i) What type of data has John collected? Put a tick (✓) in the correct box below.

Numerical Continuous	Numerical Discrete	Categorical Nominal	Categorical Ordinal
❒	❒	❒	❒

(ii) Fill in the frequency table below.

Method of Payment	Credit Card	Debit Card	Cash	Cheque
Frequency				

(iii) What is the mode of John's data? Mode = ____

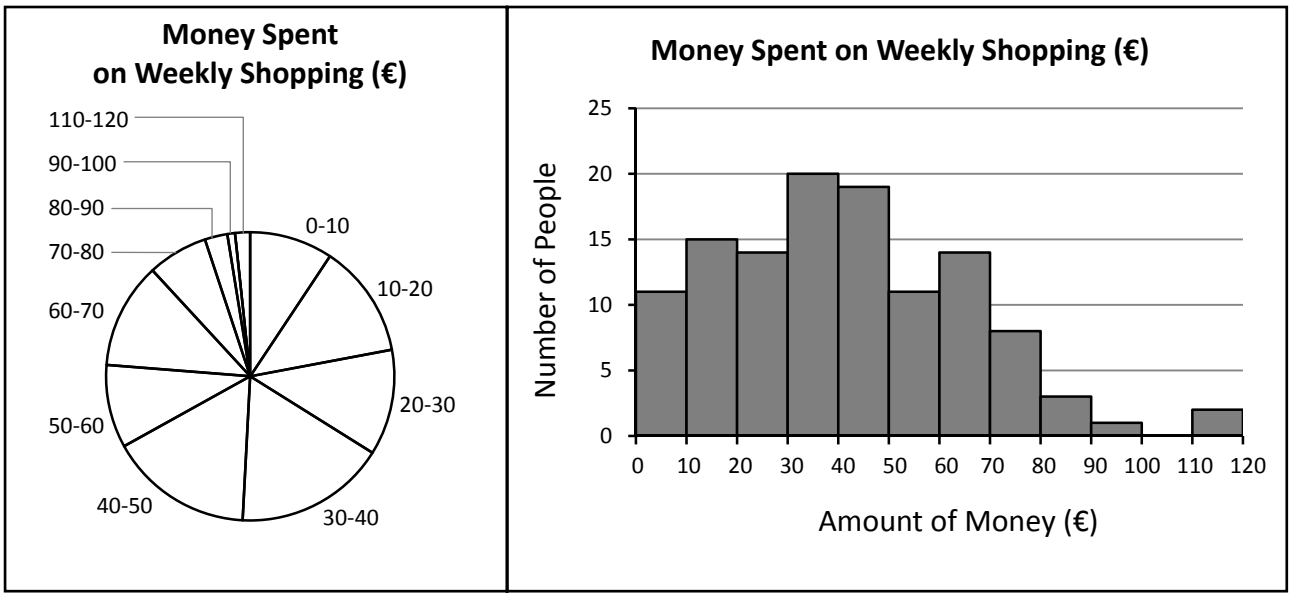
(iv) John says that he cannot find the mean of his data. Explain why this is the case.

(v) Display John's data in a pie chart. Show all of your calculations clearly.

(b) Margaret wants to examine if people prefer to do their weekly shopping in *Tesco*, *Dunnes Stores*, *SuperValu*, or *Lidl*. She stands outside her local *Lidl* shop for one day, and asks everyone as they leave the shop where they prefer to do their weekly shopping.

Give one reason why Margaret's data may be biased.

(c) Mary is interested in the amount of money people spend on their weekly shopping.
She surveys people as they leave the local supermarket on a Saturday morning, and displays her results in the two graphs below.



(i) Mary wants to show that about half of her sample spent less than €40 on their weekly shopping. Which graph do you think she should use? Give a reason for your answer.

Answer:

Reason:

(ii) Mary wants to show that there were more people in the 30–40 group than in any other. Which graph do you think she should use? Give a reason for your answer.

Answer:

Reason:

Question 6 **(Suggested maximum time: 10 minutes)**

(i) Construct a right-angled triangle ABC, where:

$$|AB| = 6 \text{ cm}$$
$$|\angle ABC| = 90°$$
$$|AC| = 10 \text{ cm}.$$

(ii) On your diagram, measure the angle $\angle CAB$. Give your answer correct to the nearest degree.

$|\angle CAB| =$ ☐

(iii) Let X be the whole number you wrote as your answer to **(ii)**.

Use a calculator to find $\cos X$. Give your answer correct to 3 decimal places.

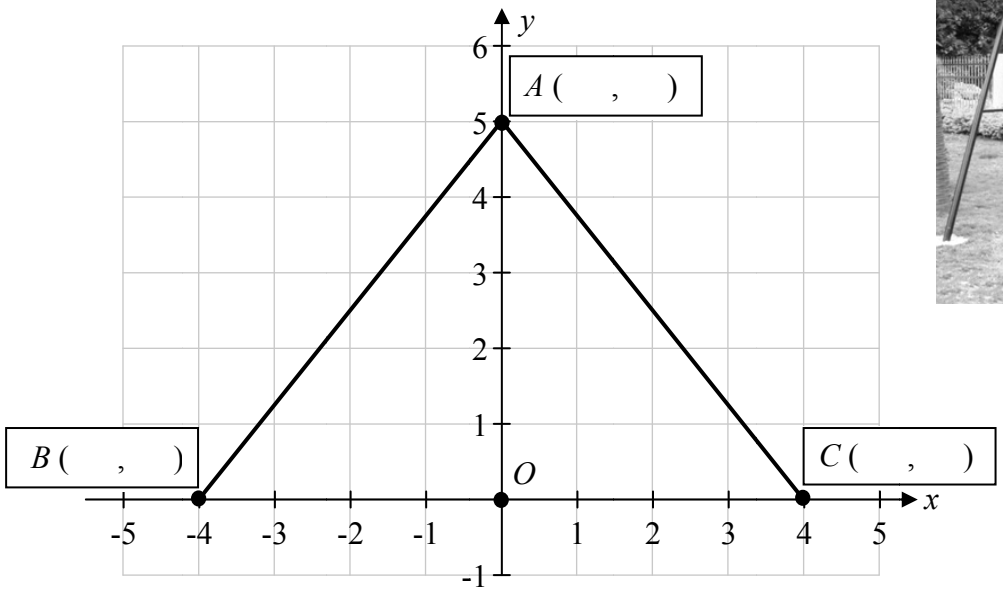
$\cos(\quad) =$

(iv) Jacinta says that $\cos(\angle CAB)$ is exactly 0·6, because $\cos(\angle CAB) = \dfrac{\text{adjacent}}{\text{hypotenuse}}$.

Explain why your answer in **(iii)** is **not** the same as Jacinta's.

Question 7 **(Suggested maximum time: 20 minutes)**

The diagram below shows part of the frame of a swing on a co-ordinate grid.
Each unit on the grid represents one metre.
The line segments $[AB]$ and $[AC]$ represent metal bars.



(i) Write the co-ordinates of the points A, B, and C in the spaces provided in the diagram.

(ii) Find the total length of metal bar needed to make this part of the swing.
Give your answer in metres, correct to one decimal place.

(iii) Find the slope of AB and the slope of AC.

AB: AC:

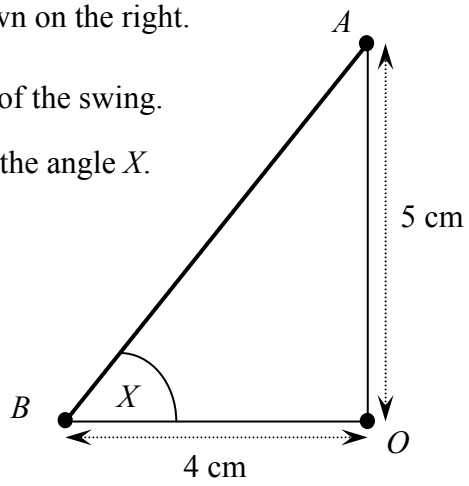
(iv) Is AB perpendicular to AC? Give a reason for your answer.

Answer:

Reason:

(v) Madison draws the scale diagram of the triangle OAB shown on the right.
She marks in the angle X.
Recall that $[AB]$ is a metal bar, which is part of the frame of the swing.

Write down the value of $\tan X$, and hence find the size of the angle X.
Give the size of the angle X correct to two decimal places.



$\tan X =$

$|\angle X| =$

In order to increase the height of the swing, it is decided to increase X by 20%.
The distance $|AB|$ will be kept the same.

(vi) Find the new height of the swing. Give your answer in metres, correct to one decimal place.

Question 8 **(Suggested maximum time: 10 minutes)**

The equation of the line l is $x - 3y - 6 = 0$.

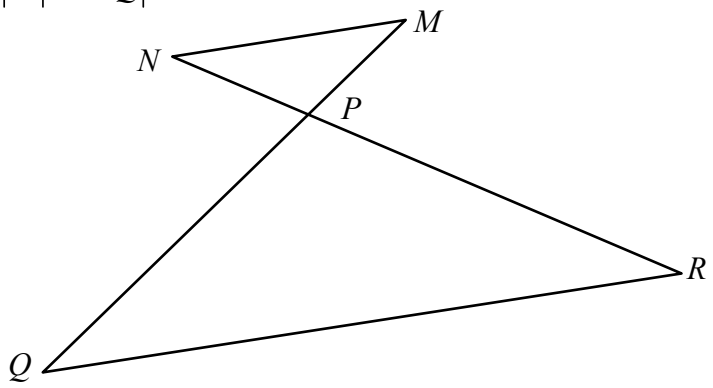
(i) Find the slope of the line l.

(ii) Show that the point $(1, -2)$ is **not** on the line l.

(iii) The line k passes through $(1, -2)$ and is parallel to the line l.
Find the equation of the line k.

Question 9 **(Suggested maximum time: 10 minutes)**

In the diagram below, $|\angle MNP| = |\angle PRQ|$.



(i) Prove that ΔMNP and ΔQRP are similar.

(ii) Is NM parallel to QR? Give a reason for your answer.

Given $|MN| = 6$, $|NP| = 4$, $|QP| = 9$, and $|PR| = 10$, find:

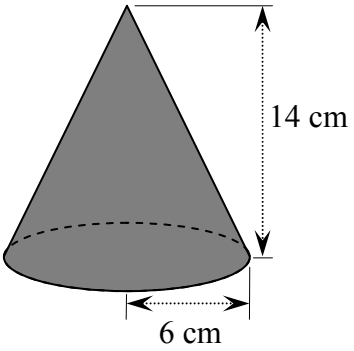
(iii) $|QR|$

(iv) $|QM|$.

Question 10 **(Suggested maximum time: 10 minutes)**

A solid cone has a radius of 6 cm and a height of 14 cm, as shown.

(i) Find the volume of the cone. Give your answer in terms of π.



The shape shown below is a *frustum*. This is made by taking the cone above, cutting it horizontally at a height of 7 cm, and removing the upper portion. The radius of the circular top of the frustum is 3 cm, as shown in the diagram.

(ii) Find the ratio of the volume of the frustum to the volume of the original cone.