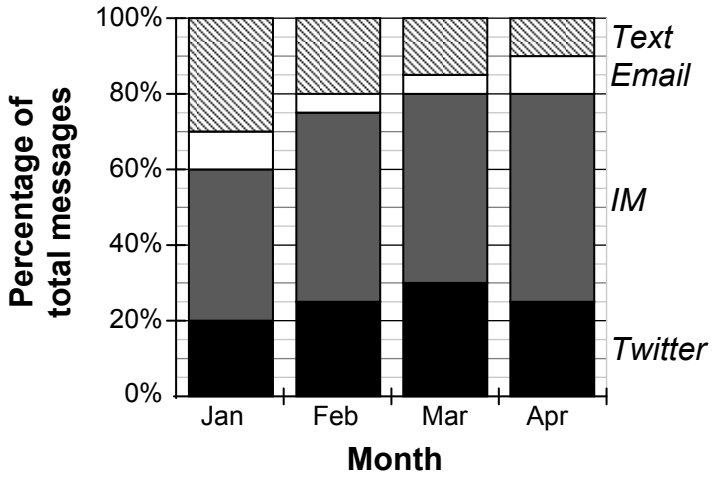
Question 1 **(Suggested maximum time: 10 minutes)**

The students in a class recorded how many messages they sent using different forms of messaging (*Text*, *Email*, *IM*, and *Twitter*) over four months.

Diagram 1 shows the percentage of messages sent using each form of messaging in each of the four months.

(a) Using **Diagram 1**, complete the table below to show the percentage of messages sent using *Email* in each of the four months.

Diagram 1



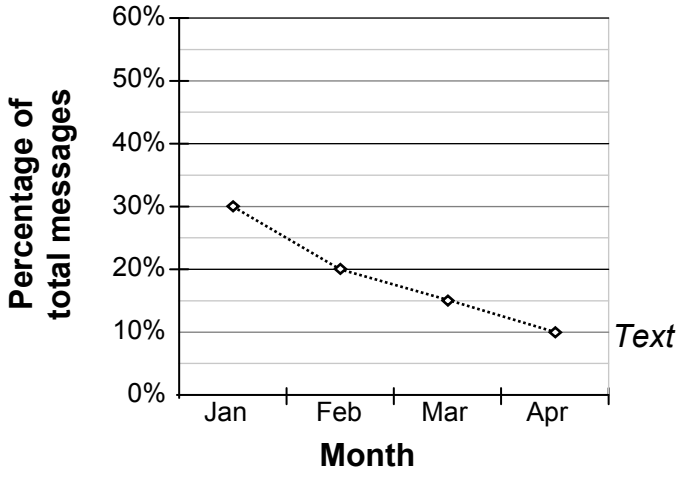
Month	Jan	Feb	Mar	Apr
Percentage of messages sent by *Email*	10%			

Diagram 2 shows the trend graph for *Text* over the four months.

(b) **Complete Diagram 2** to show the trend graphs for *Email*, *IM*, and *Twitter* over the four months, using the data in **Diagram 1**.

Label each trend graph clearly.

Diagram 2



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

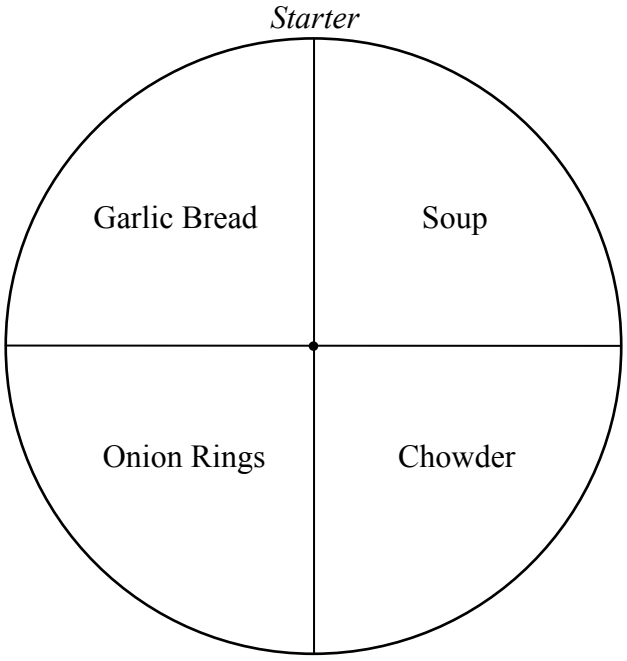
Below is a menu from a restaurant.
A 3-course dinner is made up of one *Starter*, one *Main Course*, and one *Dessert*.

Starter	*Main Course*	*Dessert*
• Soup • Garlic Bread • Onion Rings • Chowder	• Pizza • Spaghetti • Steak • Lamb • Salmon	• Cheesecake • Chocolate Cake • Ice-cream

(a) Calculate the number of different 3-course dinners that can be ordered from this menu.

In the restaurant there is a circular poster for each course, where the options are represented by sectors of equal area.

The poster for the *Starter* is shown in the diagram on the right.

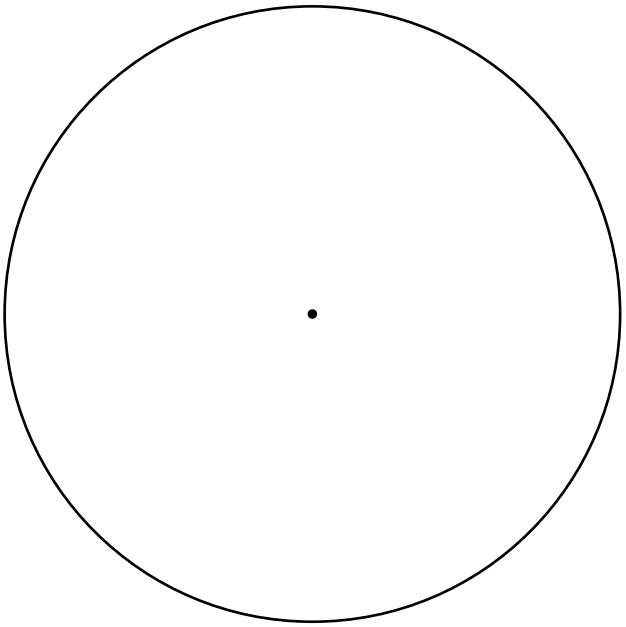


(b) **Calculate** the angle of each sector in the *Main Course* poster and each sector in the *Dessert* poster.

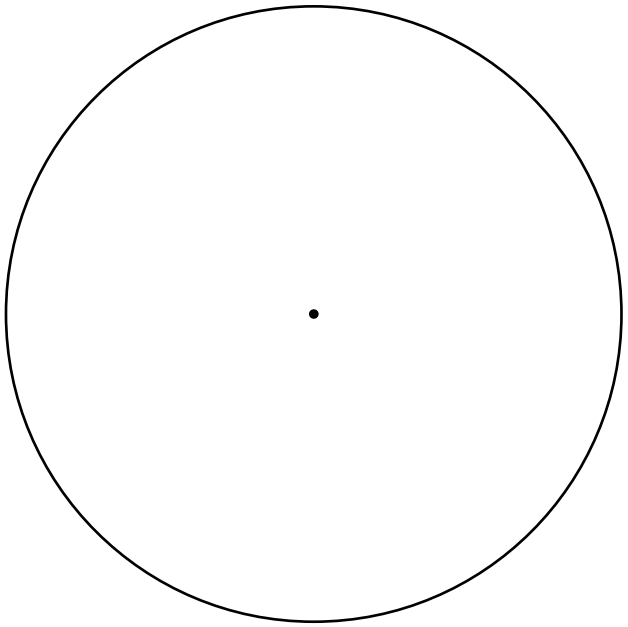
Construct these sectors in the diagrams on the next page.

Calculations:

Main Course



Dessert



(c) The owner of the restaurant wants to increase the number of different 3-course dinners that can be ordered.

She will add **either** one *Starter*, **or** one *Main Course*, **or** one *Dessert* to the menu.

Which should she add to make the number of different 3-course dinners that can be ordered as **large** as possible? Justify your answer fully.

Answer:

Justification:

Question 3 **(Suggested maximum time: 10 minutes)**

Eithne is going to survey post-primary Geography teachers in Ireland.

(a) Some of the questions in the survey are shown in the table below.
Put a tick (✓) in the correct box to show what type of data each question would give.

Question	Numerical Continuous	Numerical Discrete	Categorical Nominal	Categorical Ordinal
How many Geography classes do you teach each week?				
How much do you like teaching Geography? A lot ❒ A little ❒ Not at all ❒				
What subjects (other than Geography) do you teach?				

Eithne is going to send her survey to some of the post-primary schools in Ireland.

(b) Describe how Eithne could select a **Simple Random Sample** from all the post-primary schools in Ireland.

Eithne is considering sending her survey by email.

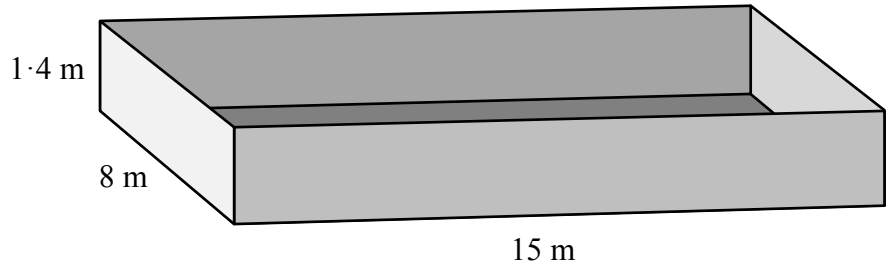
(c) State **one advantage** and **one disadvantage** of using email to collect data.

Advantage:

Disadvantage:

Question 4 **(Suggested maximum time: 10 minutes)**

A swimming pool is 15 m long, 8 m wide, and 1·4 m deep, as shown in the diagram.



Harry says: "The area of the bottom of the swimming pool is $8 \times 15 = 120 \text{ cm}^2$."

(a) Explain what is **wrong** with Harry's answer.

Harry will use $20 \text{ cm} \times 20 \text{ cm}$ tiles to cover the **inside** of the pool.

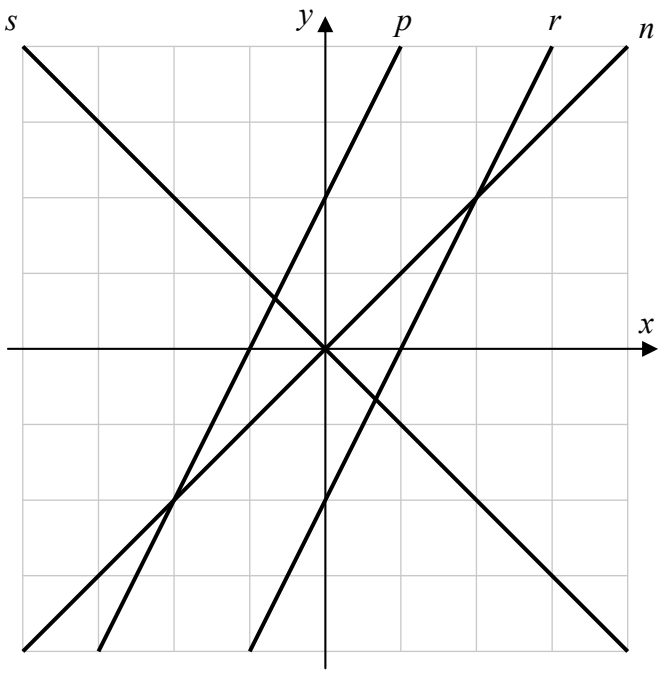
(b) Find the **minimum** number of tiles that Harry will need.

The surface of the water in the swimming pool is 10 cm below the top of the pool.

(c) Find the volume of water in the swimming pool.

Question 5 **(Suggested maximum time: 10 minutes)**

The co-ordinate diagram below shows the lines n, p, r, and s.
The table shows the equation of each line.



Equation	Line
$y = 2x - 4$	
$y = x$	
$y = -x$	
$y = 2x + 4$	

(a) Write the letters n, p, r, and s into the table to match each line to its equation.

Complete the following sentences. Write one of the letters n, p, r, or s in each box.

(b) You can use a **translation** to map the line ☐ onto the line ☐ .

(c) You can use an **axial symmetry** in the y-axis to map the line ☐ onto the line ☐ .

(d) The line ☐ is mapped onto itself under **central symmetry** in the point (0, 0).

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

The equation of the line l is $5 + y - 2x = 0$.

(a) Find the co-ordinates of the points where l cuts the axes.

l cuts the x-axis at (,)

l cuts the y-axis at (,)

(b) Find the **slope** of the line l.

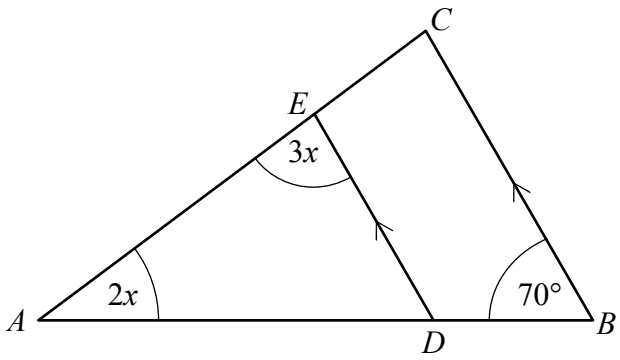
The line j goes through the point (11, 6) and is **perpendicular** to the line l.

(c) **(i)** Write down the **slope** of the line j.

(ii) Find the **equation** of the line j.

Question 7 **(Suggested maximum time: 5 minutes)**

The diagram shows the triangle ABC.
DE is parallel to BC.
The sizes of some of the angles are shown.

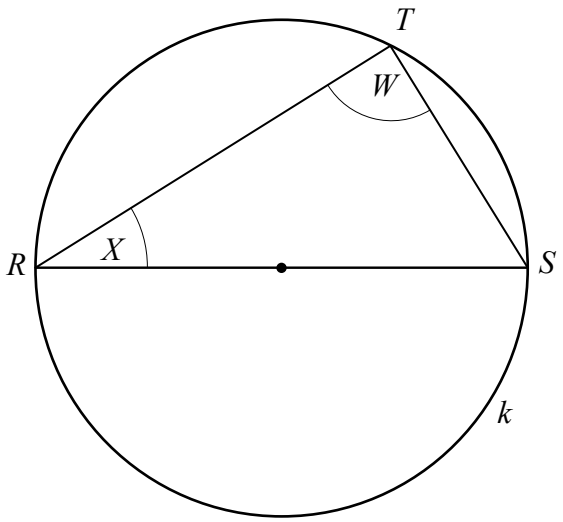


(a) Find the value of x.

(b) Given that $|AE| = 100$, $|AC| = 130$, and $|DE| = 74$, find the value of $|BC|$.

Question 8 **(Suggested maximum time: 5 minutes)**

The diagram shows the triangle RST inscribed in the circle k.
The line segment $[RS]$ is a **diameter** of the circle.



Gavin says: "The size of the angle W **must** be 90°."

(a) State one result on your course (a theorem or a corollary) that shows that Gavin is correct.

$|ST| = 10$ and $|RS| = 30$.

(b) Using this information, and trigonometry, find the size of $\angle X$.
Give your answer in degrees, correct to one decimal place.

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

A class of 25 students was surveyed to find out how many *WhatsApp* messages they each sent in a particular week. The results are shown in the table below.

Number of messages	0 – 30	30 – 50	50 – 70	70 – 100	100 – 160
Number of students	1	2	10	7	5

Note: 30 – 50 means at least 30 but less than 50, etc.

(a) A student is picked at random from the class.
Find the probability that this student sent 50 or more messages.

(b) A student is picked at random from those who sent 50 or more messages.
Find the probability that this student sent 50 – 70 messages.

(c) Using mid-interval values, estimate the **mean** number of messages sent per student.

The students also found the **total** number of *WhatsApp* messages they sent in this particular week.

(d) Use the data in the table to find the **smallest** value that this total could be.

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

There are 10 students in a class. All 10 of them sat a test.
The table below shows the **mean** mark, the **median** mark, and the **range** of the marks on the test.

	Results on the test	Answers to part **(b)**
Mean mark	25·1	
Median mark	24	
Range of the marks	14	

32 was the **highest mark** got by a student on the test.

(a) Use the range to find the **lowest mark** got by a student on the test.

An external examiner suggested that 2 be added onto each student's mark.

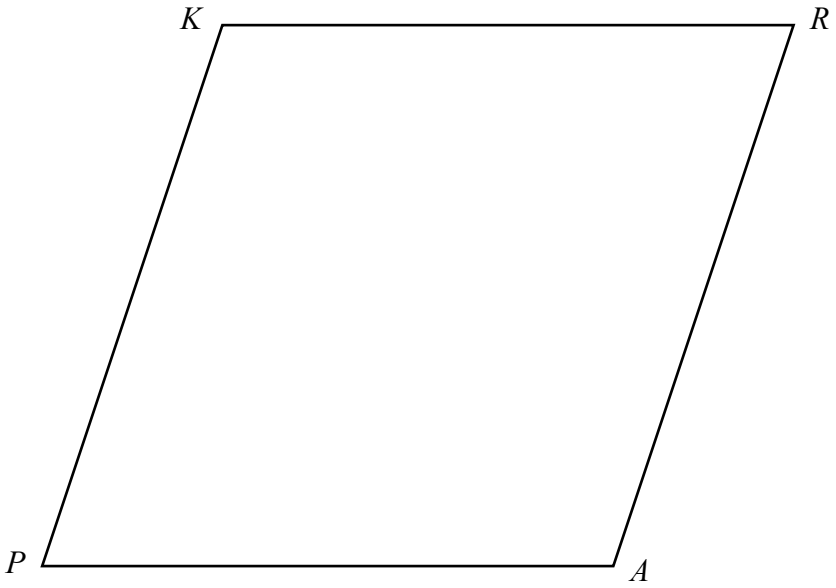
(b) Find what the **mean**, the **median**, and the **range** would be in this case.
Fill your answers into the table above.

Bob says: "Whenever the median of a list of numbers is 24, then at least one of the numbers in the list **must be 24**."

(c) Give an example to show that Bob is **not** correct.

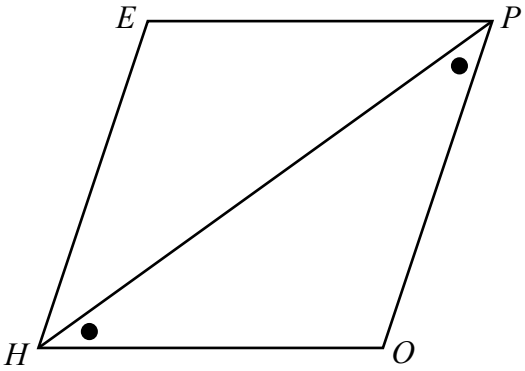
Question 11 **(Suggested maximum time: 10 minutes)**

The diagram below shows the parallelogram $PARK$.



(a) **Construct** the **bisector** of $\angle KPA$ on the diagram above, using only a compass and straight edge. Show your construction lines clearly.

The diagram on the right shows the parallelogram $HOPE$.
$|\angle PHO| = |\angle OPH|$, as shown.



(b) **Prove** that all four sides of the parallelogram are equal in length.

Give a reason for each of the statements that you make in your proof.

Question 12 **(Suggested maximum time: 10 minutes)**

(a) The triangle PQR has sides of length 8, 11, and y.
Write down **one** value of y for which $\triangle PQR$ is an **isosceles** triangle.

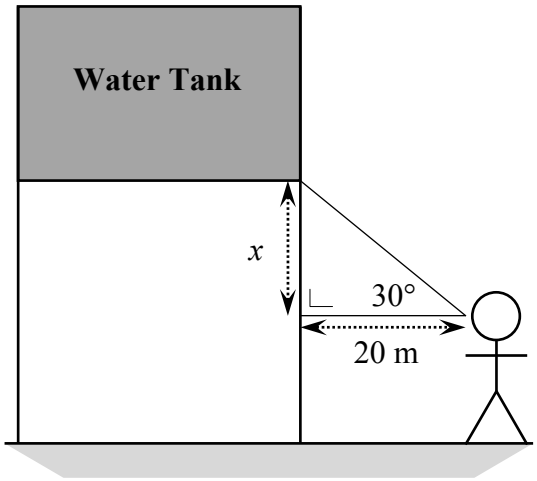
$y =$ ☐

(b) The triangle STU has sides of length 4, 7, and x.
Find the **two** values of x for which $\triangle STU$ is a **right-angled** triangle.
Give each answer in surd form.

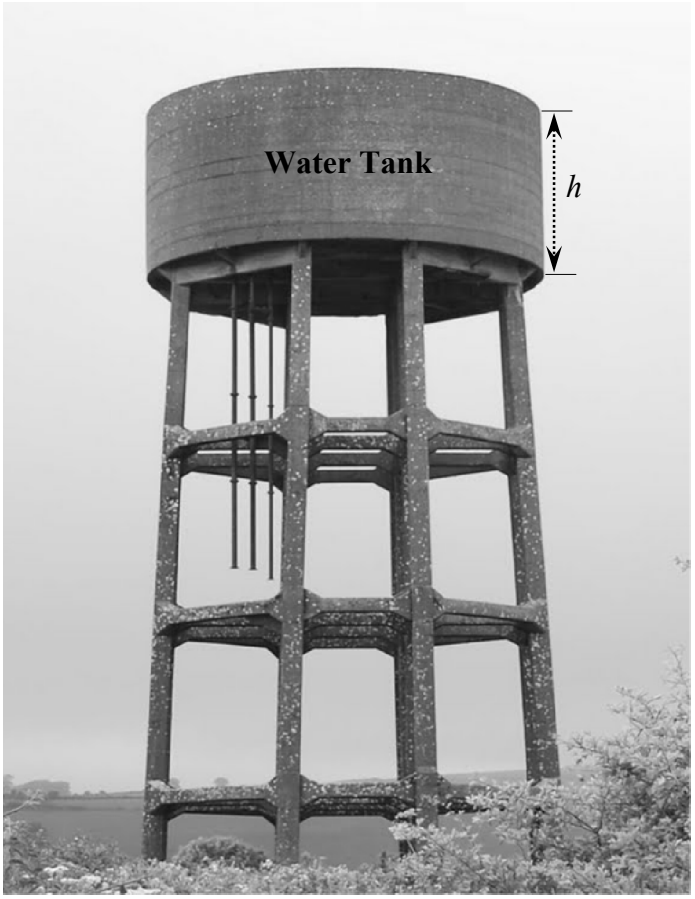
Question 13 **(Suggested maximum time: 20 minutes)**

Miriam is trying to find the volume of the water tank shown in the photograph on the right.

She takes some measurements and draws a diagram. Part of her diagram is shown below.



Diagram



Source: www.watertowersofireland.com. Altered.

(a) Using the diagram, find the value of x. Give your answer in metres, correct to two decimal places.

(b) The angle of elevation to the bottom of the water tank is 30°, as shown in the diagram. The angle of elevation to the top of the water tank is 38°. Find the distance marked h on the photograph. Give your answer correct to one decimal place.

(c) Hugh is also trying to find the volume of the water tank.
He estimates that the height, h, is 4·5 m.

By taking **measurements** from the photograph and performing **calculations**, use Hugh's value of h to estimate the volume of the water tank as accurately as you can.

Give your answer correct to the nearest m^3.
State clearly what shape you are taking the water tank to be.

Shape of the water tank:

Measurements from photograph (label each measurement):

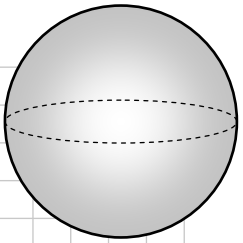
Calculations:

Volume of water tank, in m^3:

Question 14 **(Suggested maximum time: 5 minutes)**

A small sphere has a radius of 1·5 cm.

(a) Find the **volume** of the small sphere. Give your answer in cm^3, in terms of π.



The volume of a large sphere is three times the volume of the small sphere.

(b) Find the **radius** of the large sphere.

Give your answer in cm, in the form $\frac{a\sqrt[3]{a}}{b}$, where $a, b \in \mathbb{N}$.