

**1A**

Below is a menu from a restaurant.

A 3-course dinner is made up of one *Starter*, one *Main Course*, and one *Dessert*.

<i>Starter</i>	<i>Main Course</i>	<i>Dessert</i>
<ul style="list-style-type: none"> <li>• Soup</li> <li>• Garlic Bread</li> <li>• Onion Rings</li> <li>• Chowder</li> </ul>	<ul style="list-style-type: none"> <li>• Pizza</li> <li>• Spaghetti</li> <li>• Steak</li> <li>• Lamb</li> <li>• Salmon</li> </ul>	<ul style="list-style-type: none"> <li>• Cheesecake</li> <li>• Chocolate Cake</li> <li>• Ice-cream</li> </ul>

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.

**1B**

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

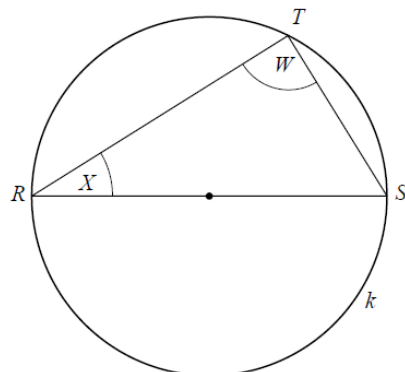
Give a reason for each of the statements that you make in your proof.

**1C**

**Explain** why  $T_{100} = T_{99} + T_{98}$ .

**1D**

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  $90^\circ$ ."

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

**1E**

Fergus wants to buy a mobile phone from one of these two companies, and wants his mobile internet bill to be as low as possible.

(d) **Explain** how your answer to part (c), the point of intersection of two lines, would help Fergus choose between *Cellulon* and *Mobil*.

2A

A small sphere has a radius of  $1.5 \text{ cm}$ .

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  $a, b \in \mathbb{N}$ .

2B

Eleanor has a **gross** income of €38 500 for the year.

She has an annual tax credit of €3300.

The standard rate cut-off point is €33 800.

The standard rate of income tax is 20% and the higher rate is 40%.

Eleanor receives a pay rise. As a result, her **net** income for the year is €34 780.

(b) Find Eleanor's new **gross** income for the year.

2C

Let  $f(x) = 3x + 5$ , for  $x \in \mathbb{R}$ . Find the value of  $k$  for which  $f(k) = k$ .

2D

The length of the hypotenuse,  $h$ , of triangle  $x$  in this sequence is given by the function below, where  $b$  and  $c$  are integers.

$$h(x) = 2x^2 + bx + c$$

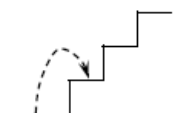
Also,  $h(1) = 5$  and  $h(2) = 13$ .

Use this information to write two equations in  $b$  and  $c$ .

Solve these simultaneous equations to find the value of  $b$  and the value of  $c$ .

2E

A boxer runs up stairs as part of her training.  
She can go up 1 step or 2 steps with each stride, as shown.



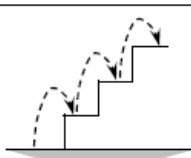
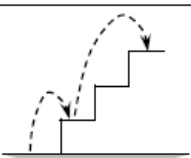
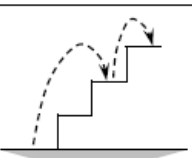
Up 1 step



Up 2 steps

The boxer wants to count how many different ways she can reach the  $n$ th step.  
She calls this  $T_n$ , the  $n$ th Taylor number.

For example, she has 3 different ways to reach the 3rd step, as shown in the tables below.  
So  $T_3 = 3$ .

3rd step: way 1	3rd step: way 2	3rd step: way 3
Up 1 step, then 1 step, then 1 step	Up 1 step, then 2 steps	Up 2 steps, then 1 step
$1 + 1 + 1$	$1 + 2$	$2 + 1$
		

(a) Find the value of  $T_1$  and  $T_2$ .

List all the different ways that she can reach the 4th step; one way is already done for you.  
Hence write down the value of  $T_4$ .

Different ways to reach the 4th step:  $1 + 1 + 1 + 1$

### 3A

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

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?  <div style="display: flex; justify-content: space-around;"> <span>A lot <input type="checkbox"/></span> <span>A little <input type="checkbox"/></span> <span>Not at all <input type="checkbox"/></span> </div>				
What subjects (other than Geography) do you teach?				

## 3B

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

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

## 3C

Hugh is also trying to find the volume of the water tank.



State clearly what shape you are taking the water tank to be.

Shape of the water tank:	
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## 3D

The triangle  $PQR$  has sides of length 8, 11, and  $y$ .

Write down **one** value of  $y$  for which  $\triangle POR$  is an **isosceles** triangle.

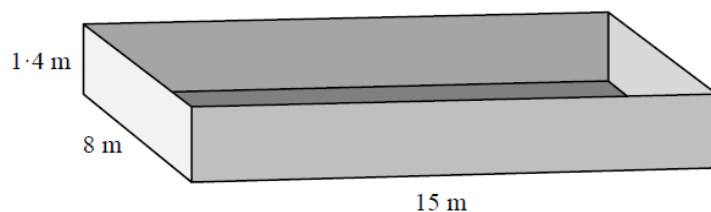
## 3E

Complete the following identity.

$$A \cup (B \cap C) = (A \cup B) \cap (\underline{\hspace{2cm}})$$

**4A**

A swimming pool is 15 m long, 8 m wide, and 1.4 m deep, as shown in the diagram.



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.

## 4B

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.

**4C**

Write the following as a single fraction in its simplest form.

$$\frac{x+2}{3} - \frac{x-3}{4}$$

## 4D

Factorise  $x^2 + 7x - 30$ .

Hence, or otherwise, solve the equation  $x^2 + 7x - 30 = 0$ .

## 4E

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

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

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  $j$ .

Find the equation of the line  $j$ .