2022. S32

2022J003G1EL

Coimisiún na Scrúduithe Stáit
State Examinations Commission

# Junior Cycle Final Examination 2022

# Mathematics

## Ordinary Level

## Friday 10 June Afternoon 1:30 - 3:30

270 marks

**Examination Number**

**Day and Month of Birth**

For example, 3rd February is entered as 0302

| *For Superintendent* |
|---|
| Centre Stamp |

| *For Examiner* | |
|---|---|
| Running total | |
| Grade | |

| *For Examiner* | | | | | |
|---|---|---|---|---|---|
| Q. | Ex. | Adv. Ex. | Q. | Ex. | Adv. Ex. |
| 1 | | | 11 | | |
| 2 | | | 12 | | |
| 3 | | | 13 | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | Total | | |

## Instructions

There are 13 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. You may ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

You may lose marks if your solutions do not include supporting work.

You may lose marks if you do not include the appropriate units of measurement, where relevant.

You may lose marks if you do not give your answers in simplest form, where relevant.

Write the make and model of your calculator(s) here:

**Question 1** **(Suggested maximum time: 5 minutes)**

**(a)** Find the value of each of the following.

**(i)** $243 + 178$

**(ii)** $7{\cdot}2 \times 6$

**(iii)** $24 \div (9 - 7)$

**(iv)** $3^4$

**(b)** Write down the **whole number** that is nearest to $15{\cdot}8$.

**(c)** What number is half way between $16$ and $30$?

**Question 2** **(Suggested maximum time: 10 minutes)**

A restaurant has the following menu, with 4 main courses and 3 desserts:

| Main Course | Price € |
|---|---|
| Fish | 16·95 |
| Steak | 18·95 |
| Pasta | 14·95 |
| Pizza | 15·95 |

| Dessert | Price € |
|---|---|
| Ice-cream | 3·50 |
| Cheesecake | 4·95 |
| Brownie | 4·50 |

**(a)** **(i)** John orders a steak and cheesecake. Work out the price of John's meal.

**(ii)** John pays for the meal with a €50 note. How much change should he get?

**(b)** Michelle picks one main course and one dessert.
In how many different possible ways could she do this?
For example, one possible way is to pick fish and ice-cream.

**(c)** Gina orders food costing €72.
Gina gives a tip of 15% of this cost, rounded to the nearest euro.

Work out how much Gina gives as a tip.

**(d)** There are 5 waiters and 3 kitchen staff working in the restaurant.
At the end of each night, the tips are all added together, and are then split evenly between these 8 people.

One night, the 3 kitchen staff get a combined total of €96 in tips.
Work out the **total** value of all the tips that evening.

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

Joshua estimates that an airbed is roughly in the shape of a rectangular solid.
The dimensions of the airbed are $180$ cm by $80$ cm by $20$ cm.


**(a)** Use Joshua's values to show that the **volume** of the airbed is $288\,000$ cm$^3$.

**(b)** Joshua uses an electric pump to blow up the airbed.
The pump blows air into the airbed at a rate of $800$ cm$^3$ per **second**.
Work out how many **minutes** it will take to fill the airbed with air, using this pump.

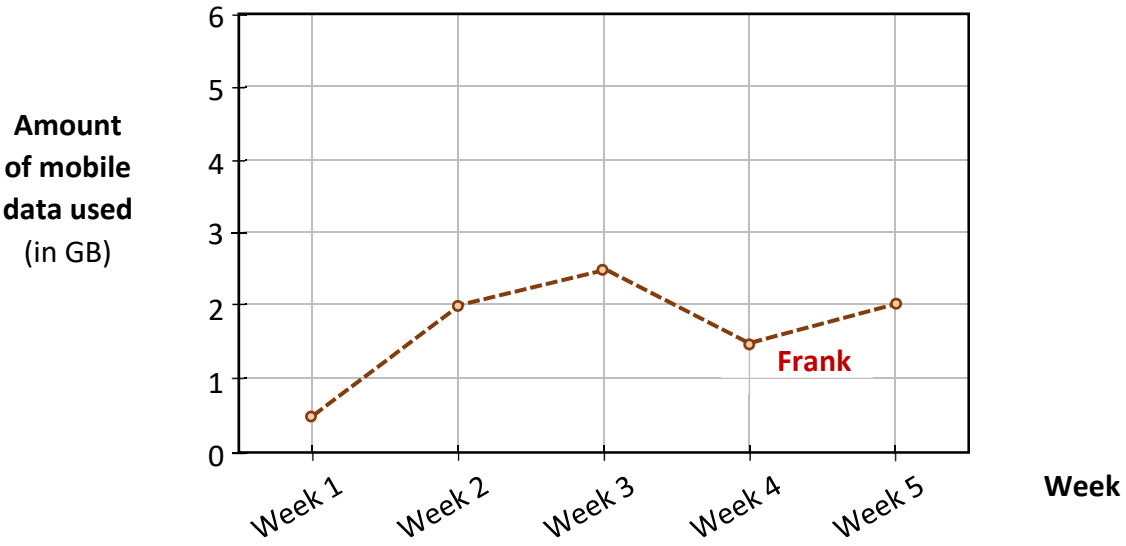
**(c)** Joshua finishes pumping up the airbed at $9{:}35$ p.m.
He goes to bed $45$ minutes later.

At what time does Joshua go to bed?

**(d)** Joshua buys the electric pump on the internet for £$15{\cdot}95$.
The currency conversion rate is €$1 =$ £$0{\cdot}90$.
Convert £$15{\cdot}95$ to euro. Give your answer correct to the nearest cent.

**Question 4** **(Suggested maximum time: 5 minutes)**

Frank and Ciarán each recorded how much mobile data they used each week for five weeks.
The graph below shows the amount of mobile data that Frank used in each of these weeks.




**(a)** Based on the graph:

**(i)** in which week did Frank use the **most** mobile data?

Answer:

**(ii)** how many GB of mobile data did Frank use in **Week 5**?

Answer:

**(iii)** in which week did Frank use **less** mobile data than the week before?

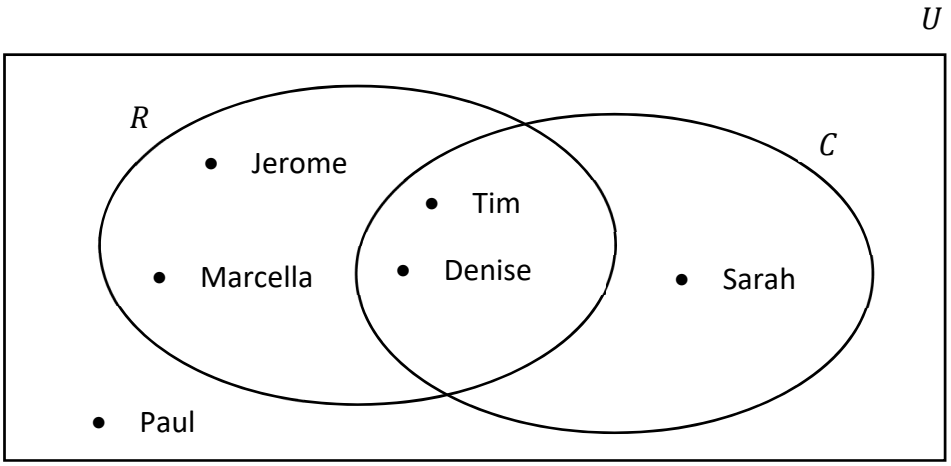
Answer:

**(b)** In each of these weeks, Ciarán used **2 GB of data more** than Frank used.

Use this information to draw a graph on the diagram above showing how much mobile data Ciarán used in each of these weeks.

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

6 students in a class ($U$) were asked if they ran ($R$) or cycled ($C$) during the midterm break.
The Venn diagram shows their responses.




**(a)** Name one student who **ran** during the midterm break.

Answer: _____

**(b)** Explain what the following statement means, in terms of the students in the class:

$$\#\, C = 3$$

**(c)** Name one student who is in the region $R \cap C$ in the Venn diagram.

Answer: _____

**(d)** One student is picked at random from the six students in the Venn diagram.
Write down the probability that this student **ran** during the midterm break.

Answer: $\frac{\quad}{\quad}$

**Question 6** **(Suggested maximum time: 15 minutes)**

All the students in fourth year in a school took part in a long-jump competition.
The results are shown in the following frequency table.

| **Distance jumped** (cm) | $200 - 250$ | $250 - 300$ | $300 - 350$ | $350 - 400$ | $400 - 450$ | $450 - 500$ |
|---|---|---|---|---|---|---|
| **Number of students** | 10 | 15 | 25 | 32 | 10 | 3 |

**(a)** In **total**, how many students took part in the competition?

Answer: ☐

**(b)** What is the **modal** group of the frequency table? Tick (✓) **one** box only.

| $300 - 350$ | $350 - 400$ | $400 - 450$ | $450 - 500$ |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

**(c)** To qualify for the final, a student must jump $\mathbf{415}$ **cm or more**.

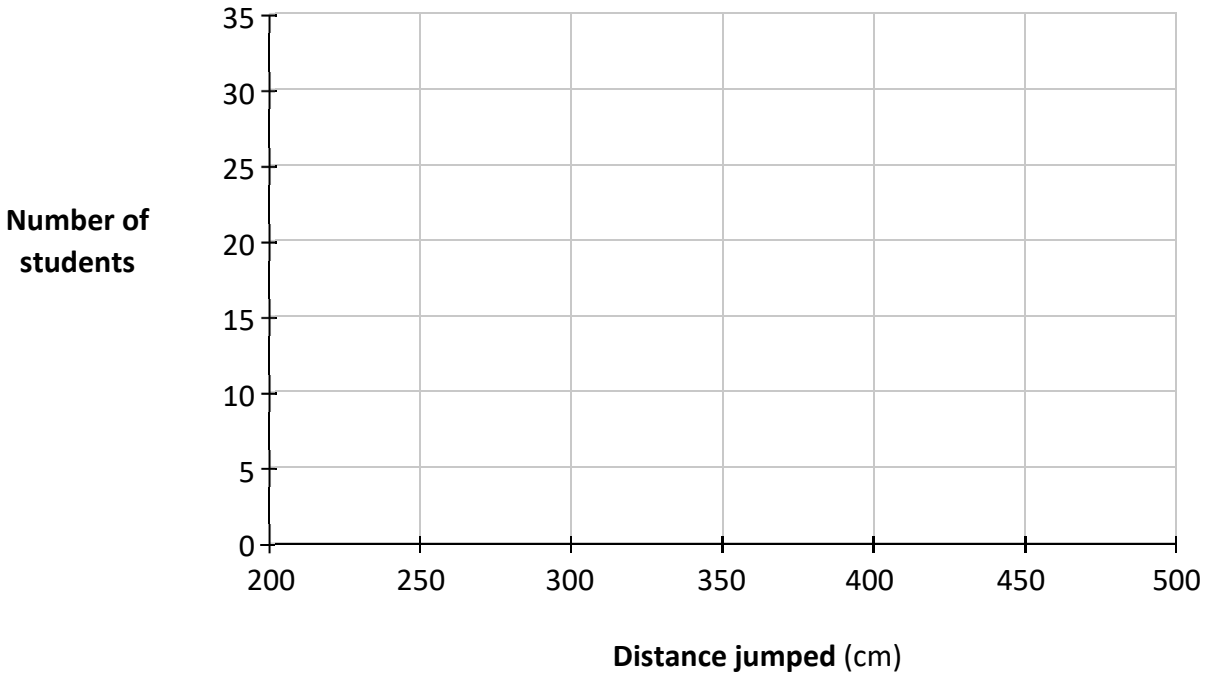
**(i)** What is the **least** number of students who could have qualified for the final?

Answer: ☐

**(ii)** What is the **greatest** number of students who could have qualified for the final?

Answer: ☐

**(d)** Draw a **histogram** to represent the data from the frequency table.
Use the axes and scales below.

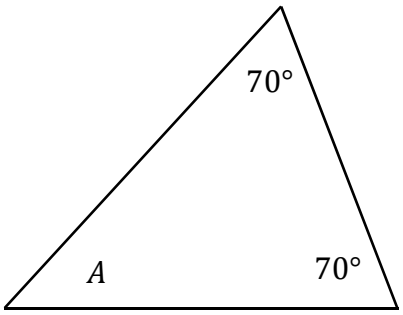



**(e)** The **median** distance jumped was $331$ cm.

Explain what this means, in terms of how far the students jumped in the long-jump competition.

**Question 7** **(Suggested maximum time: 10 minutes)**

**(a)** The triangle below has two angles of size $70°$, as shown (diagram not to scale).



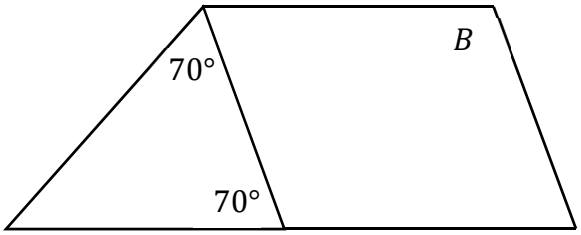

**(i)** What type of triangle is this? Tick (✓) **one** box only.

| Right-angled | Isosceles | Equilateral |
|---|---|---|
| ☐ | ☐ | ☐ |

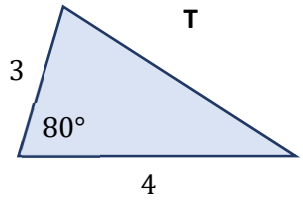
**(ii)** Work out the size of the angle $A$, the third angle in this triangle.

**(iii)** This triangle is joined to a parallelogram, as shown below.
The angle $B$ in the parallelogram is marked.

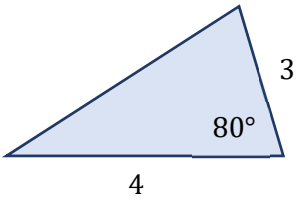
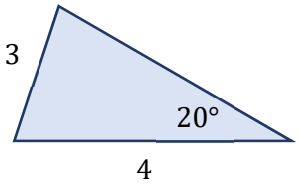
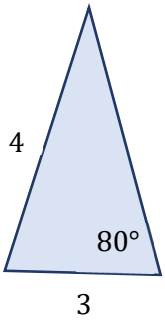
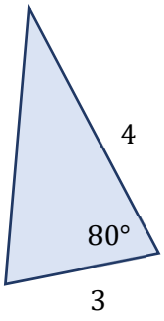
Work out the size of the angle $B$.



**(b)** The diagram below shows the triangle **T**.
The lengths of two sides and the size of one angle are shown.

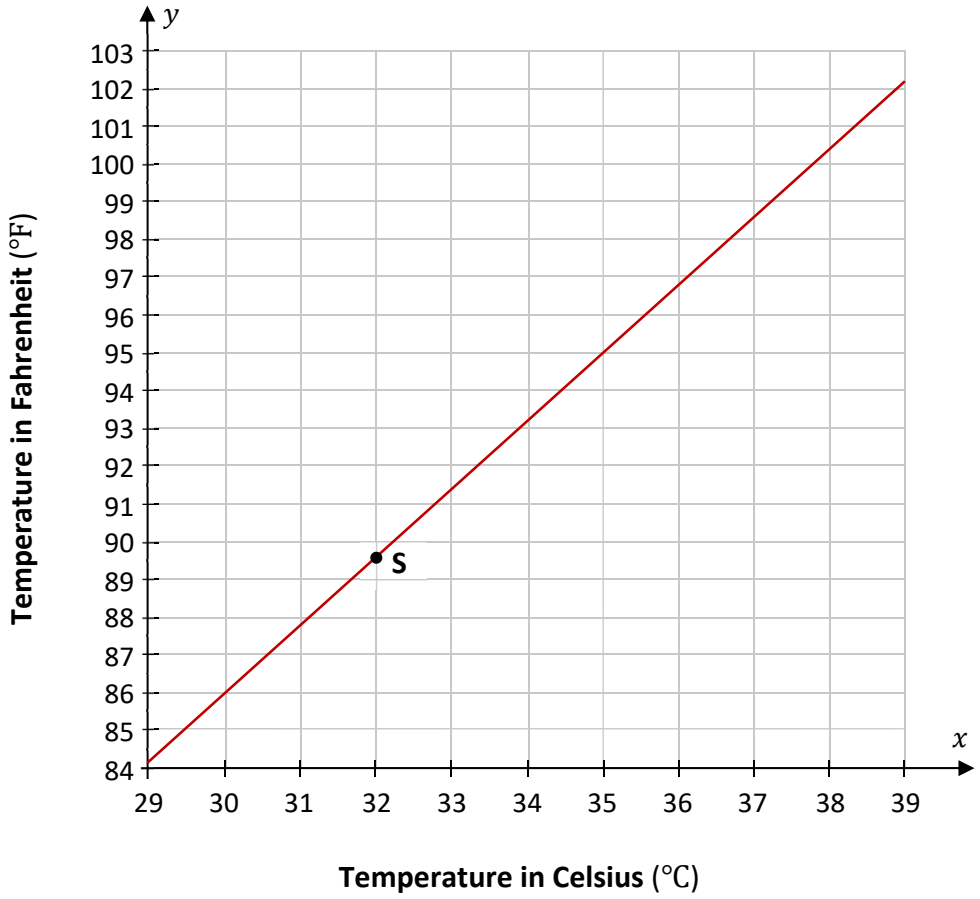



4 more triangles are shown below.
For each triangle, tick (✓) the correct box to show if it is **definitely congruent** to **T** or not.

| Triangle | Is this triangle definitely congruent to T? | |
|---|---|---|
|   | Yes ☐ | No ☐ |
|   | Yes ☐ | No ☐ |
|   | Yes ☐ | No ☐ |
|   | Yes ☐ | No ☐ |

**Question 8** **(Suggested maximum time: 15 minutes)**

The graph on the co-ordinate diagram below shows the relationship between degrees Celsius (°C) and degrees Fahrenheit (°F). The axes do **not** start at $(0, 0)$ in the diagram.




**(a)** For parts **(a)(i)** and **(a)(ii)**, **show your work on the diagram above**.

**(i)** Normal temperature for an adult is $37°C$.
Write $37°C$ in degrees Fahrenheit.

Answer: _____

**(ii)** A temperature above $100{\cdot}4°F$ is a high temperature. Write $100{\cdot}4°F$ in degrees Celsius.

Answer: _____

**(b)** The point **S** is marked on the graph. Estimate the co-ordinates of the point **S**.

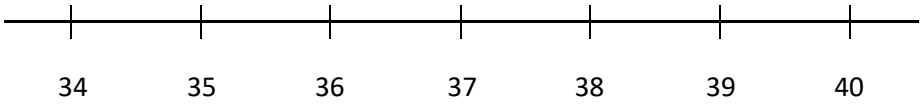
**S**: ( , )

**(c)** The points $(35, 95)$ and $(30, 86)$ are also on the graph of the line.
Use these two points to work out the **slope** of the graph.

**(d)** The table below gives two inequalities in $T$ (a temperature in ℃), and a description of two inequalities in $T$. Complete the table by filling in the missing description and inequality.

| | Description | Inequality |
|---|---|---|
| **1** | Temperature is less than $36$℃ | $T < 36$ |
| **2** | | $36 < T < 38$ |
| **3** | Temperature is greater than $38$℃ | |

**(e)** **Graph** the inequality $T < 36$ on the number line below, where $T \in \mathbb{R}$ ($T$ is a real number).



**Question 9** **(Suggested maximum time: 5 minutes)**

Margaret makes and sells furniture.

**(a)** It costs Margaret €75 to make a chair. She sells it for €110.
Work out the **profit** she makes on the chair.

**(b)** It costs Margaret €120 to make a bench. She sells it for a profit of €45.
Work out how much Margaret **sells** the bench for.

**(c)** It costs Margaret €$3n$ to make a stool, where $n \in \mathbb{N}$.
She sells the stool for €$5n$.
Work out the **profit** she makes on the stool, in terms of $n$.

**(d)** It costs Margaret €320 to make a table. She sells it for a profit of €80.
Write Margaret's profit for the table as a **percentage** of its cost to her.

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

**(a)** Write the following as a single fraction in its simplest form:

$$\frac{2}{3} + \frac{5}{7}$$

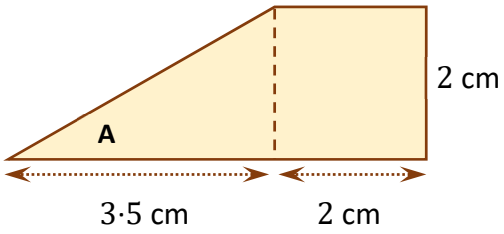
**(b)** Solve the following equation in $k$:

$$4k - 7 = 41$$

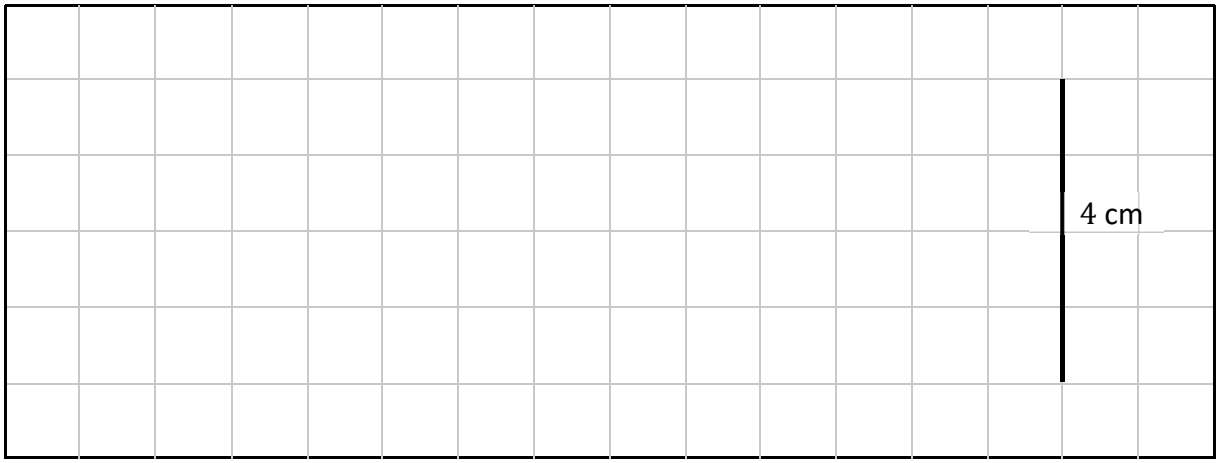
**Question 11** **(Suggested maximum time: 10 minutes)**

Two friends are building a skate-board ramp.
They each have a different design for the ramp.


**(a)** Tracey draws the following diagram as part of her design for the ramp.
It is made up of a triangle and a square.
It is to a scale of $1:100$.
The angle **A** is marked.



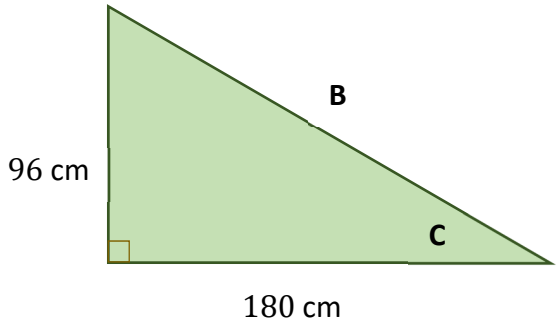

**(i)** Construct a scale diagram of this part of the design for the ramp in the grid below, to a scale of $1:50$. Each side in your diagram should be twice the length of the corresponding side in Tracey's diagram. One side is already done for you.




**(ii)** Measure the size of the angle **A** in Tracey's diagram above.

Answer: ____

Sinéad has a different design for the ramp.
Part of Sinéad's design is the right-angled triangle in the diagram below (not to scale).
One of the sides is marked **B**. One of the angles is marked **C**.




**(b)** Use the **Theorem of Pythagoras** to work out the length of the side **B** in Sinéad's design.
Give your answer in cm.

**(c)** Sinéad knows that, for the angle **C**,

$$\tan \mathbf{C} = \frac{96}{180}$$

Use your calculator to find the size of the angle **C**, correct to the nearest degree.

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

In January 2021, people were allowed to travel 5 km from their home to exercise.


**(a)** Write **km** or **km²** into each box below to complete the following sentence correctly.
Use each one only once.

**Area** is measured in ☐ and **distance** is measured in ☐ .

**(b)** Use the following formula to work out the circumference of a circle with a radius of 5 km.
Give your answer correct to 1 decimal place.

$2 \times \pi \times r =$

**(c)** Use a different formula to work out the **area** of a circle with a radius of 5 km.
Give your answer correct to 1 decimal place.

**(d)** The tables below show the circumference and area of a circle in terms of $\pi$, as the radius increases by 2 units. One of these is a **linear** sequence; the other is **not**.

| **Sequence 1**<br>Circumference |
|---|
| $8\,\pi$ |
| $12\,\pi$ |
| $16\,\pi$ |
| $20\,\pi$ |
| $24\,\pi$ |

| **Sequence 2**<br>Area |
|---|
| $16\,\pi$ |
| $36\,\pi$ |
| $64\pi$ |
| $100\,\pi$ |
| $144\,\pi$ |

Tick (✓) the correct box to show which of these sequences is **linear**.
Give a reason for your answer.

The linear sequence is: **Sequence 1** ☐ **Sequence 2** ☐

(tick **one** box only)

Reason:

**Question 13** **(Suggested maximum time: 5 minutes)**

**(a)** Simplify $2a - 5n + 2n + 6a$.

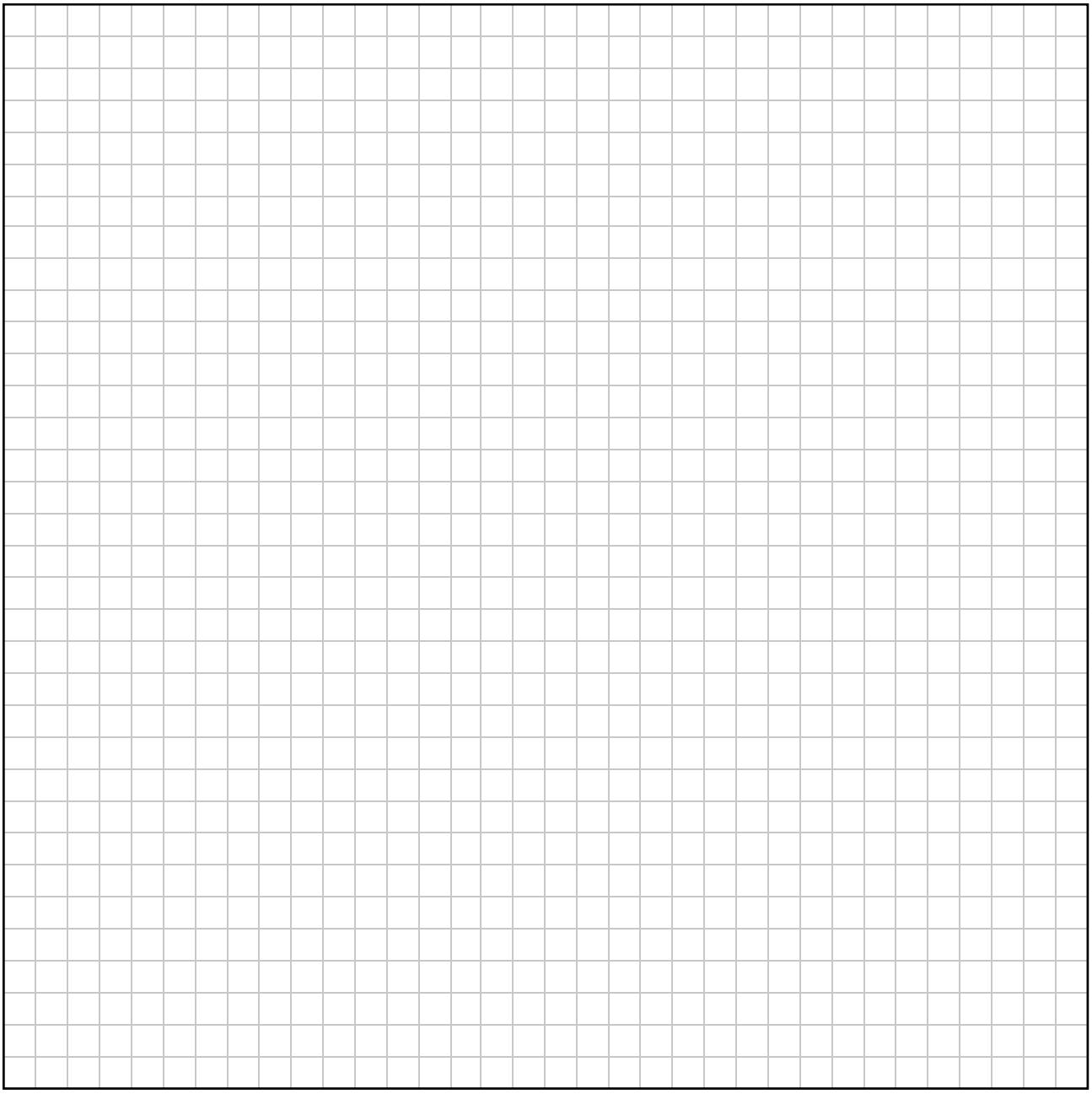
**(b)** $y = \frac{3n + 70}{5}$.

Work out the value of $y$ when $n = 10$.

**(c)** Factorise the quadratic expression $x^2 - 7x + 12$ .

$x^2 - 7x + 12 = (x \quad )(\quad )$

Page for extra work.
Label any extra work clearly with the question number and part.



**Acknowledgements**

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Junior Cycle Final Examination – Ordinary Level

# Mathematics

Friday 10 June
Afternoon 1:30 - 3:30