## Set B: Review Materials - Junior Certificate Strand 1 and Strand 2

Before you attempt these questions have a look at the "Geometry and Trigonometry Tutorial" https://emea67395290.adobeconnect.com/_a858841383/maths/ the Using Geometry and Trigonometry to solve problems presentation
https://emea67395290.adobeconnect.com/_a858841383/p15113 229/presentation
and the concept of slope presentation.

This set of questions; compiled in two documents are intended to help you as you review your work in preparation for Paper 2 in the Junior Certificate examination. They are not intended to be exact matches of what will come up in the exam but they should give you a flavour of how the concepts can be examined in context. Other questions and activities can be found in the Mathematics Resources for Students on the student zone at www.ncca.ie/projectmaths

## Task 1: JCOL

Jason had these sticks.


He wanted to make two right-angled triangles.

He picked up three sticks and found he could not make a right-angled triangle.
(a) Which three sticks might Jason have picked up?

(b) Why did these three sticks not make a right-angled triangle? Use a theorem from your geometry course to help you explain.

(c) Choose three sticks that will make a right-angled triangle.
$\qquad$
(d) Choose three other sticks which will also make a rightangled triangle.
(e) Show how you know that, in each of these cases, the sticks will make a right-angled triangle.


## Extension to LCOL

## Jason had these sticks.



He wanted to make two triangles.

He picked up three sticks, but he could not make a triangle with them.
(a) Which three sticks might Jason have picked up?

(b) Why did these three sticks not make a triangle? Use a theorem from your geometry course to help you explain.

(c) Choose three sticks that will make a triangle?

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(d) Choose three other sticks that will also make a triangle?


Accurately construct one of the triangles using the measurements that you have chosen. Show all your construction marks.

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## Task 2: JCHL


(a) In the picture above, what is the sum of angles numbered 1, 2 and 3? Explain the reasoning that led to your answer.

(b) In the picture above, the angle numbered 1 is equal in measure to one of the angles in the triangle. Which one?

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(c) In the picture above, angle 2 is equal in measure to one of the angles in the triangle. Which one?

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(d) In the picture above, the angle numbered 3 is equal in measure to one of the angles of the triangle. Which one?

(e) Use your answers to questions (a)-(d) to explain why the sum of the angles numbered 4,5 and 6 is $180^{\circ}$.


Explain why this would be true for any triangle, and not just the one pictured. Use the following guide.

## Given:

To prove:

## Proof:



Note: The proof of this theorem is not examinable. However, you should be able to set out your explanation using the sequence of thinking that was involved in the task above.

## Task 3: JCOL

Francesca and Leo were dissecting shapes and rearranging them to form new shapes.
One of their tasks is shown below

Transform this right-angled triangle into a rectangle by dissecting it and rearranging the parts.


On the diagram below accurately follow Francesca's instructions. Show all construction marks clearly.

(a) Accurately complete Leo's instructions in the box below

(b) What theorem was Leo referring to when he said " ..CE will line up with AE. They are equal 'cos of that theorem..."

Why are CE and AE equal?
(c)Leo says that the re-arranged shapes will make a rectangle.

Do you agree with Leo?
Explain your thinking. You will need to write down some properties of a rectangle and show how the figure Leo ends up with has these properties.


## Task 4: JCHL

Calculate the height of
(a) an equilateral triangle of side length $x$
(b) an isosceles triangle of side lengths $x$ and $y$


## Task 4: JCHL

Of the four lines pictured below, one has a slope of 0 , one has a slope of 1 , another has a slope of -1 , and another has an undefined slope. Complete the table to show which is which.


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| Line $a$ has slope: |  |
| Line $b$ has slope: |  |
| Line $c$ has slope: |  |
| Line $d$ has slope: |  |

Give reasons for your choices.

## Task 5: JCHL

The cost of transporting documents by courier can be represented by the following straight line graph.


Use the graph to help you work out how the courier charges customers.


How much would the courier charge to transport documents a distance of 30 km ?


Eoin's company is working to a tight budget. They need to transport documents 15 km across the city.
Eoin gets a quote from another company who claim to be cheaper.
Their advertisement reads

## Cheapest courier in town

We charge $€ 3.50$ / km and no standing charge.

Which courier should Eoin ask to transport his documents across the city? Justify your decision by comparing the prices charged for this job by both companies.

Can the second company stand by their claim of being the cheapest courier in town?
Justify your answer by referring to a graphical representation of each company's charges.

Task 6: JCFL

Draw the following shapes on the coordinate axes.

- a square
- a right angled triangle
- an isosceles triangle
- a parallelogram


Write down the co-ordinates of the vertices of each shape

Square (....., ....) (....., ....) (....., ....) (....., ....)

Right- angled triangle (....., ....) (....., ....) (....., ....)

Isosceles triangle (....., ....) (....., ....) (....., ....)

Parallelogram (....., ....) (....., ....) (....., ....) (....., ....)

## Task 7: JCOL

You're locked out of your house and the only open window is on the second floor, 7m above the ground. You need to borrow a ladder from one of your neighbours. There's a bush along the edge of the house, so you'll have to place the bottom of the ladder 3m from the house. What length of ladder do you need to reach the window?


Sketch a mathematical diagram. Use straight lines to represent the wall of the house, the ladder and the ground. Mark each line with the correct measurement. If you do not know the measurement mark it x .

Use your geometry to calculate the length of the ladder needed.

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The diagram is taken from a safety manual that accompanies a particular brand of ladder.

You can see from the diagram that the length of a ladder that you would choose for a particular job depends on the height of the object it will be leaning up against.

Generalise this relationship. Use surds in your answer.

Does the angle the ladder makes with the horizontal depend on the height of the object it is leaning up against? Explain your answer.
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Task 8: JCHL


The straw is 20 cm long.
Calculate the length of the straw sticking out from the top of the glass.

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## Task 9: JCHL

An installation guide for the Sandringham Electric Attic ladder is shown below


| Ladder Size | Floor to Floor Height $\mathrm{C}_{2}$ | Storage swing and Height | Horizontal Distance F |
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|  | 250 cm | 145 cm | 159 cm |
| Length ${ }^{\text {cm }}$ | 260 cm | 155 cm | 166 cm |
|  | 270 cm | $s^{3}$ | 173 cm |
|  | 280 cm | 175 cm | 180 cm |
| Length 150 cm |  | 146 cm | 166 cm |
| - | 280 cm | 166 cm |  |

Some ink has spilled on the table. Use your mathematics to find the lengths covered by the ink blots. If you are unable to calculate a particular missing length, explain why you are unable to do so.


## Task 10: JCFL

Plot the points $(-1,2),(5,2),(-1,-1)(5,-1)$ on the grid.


Join them to form a shape.
What is the name given to this shape?


Write down two properties of that shape.

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Task 11: JCOL
Plot the points $(-1,2),(5,2),(-1,-1)(5,-1)$ on the grid.


Join them to form a shape.
What is the name given to this shape?


Write down two properties of that shape.


Prove that the shape you have made on the grid has those properties.
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## Task 12: JCHL

Plot the points (8, 2), (8,-4), (2,-1) on the grid.


Join them to form a shape.
What is the name given to this shape?

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Write down two properties of that shape.


Prove that the shape you have made on the grid has those properties
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## Task 11: JCFL

## Say which of the following is true by ticking the correct box

 In the diagram below:One $\mathbf{F}$ is the image of the other after an axial symmetry $\square$
One $\mathbf{F}$ is the image of the other after a central symmetry $\square$
One $\mathbf{F}$ is the image of the other after a translation $\square$


Draw as many lines as symmetry as possible for each figure below.


Use tracing paper or fold the shape to help find the lines of symmetry. Look for patterns or properties of these lines.


## Task 12: JCHL



A monorail similar to the one shown was planned for an amusement park.

The original plans had the supports located as shown on the grid below.

A $(7,12) B(9,2) C(15,1) D(3,5)$


In order to make room for a car park, engineers have decided to demolish the supporting pillar C and relocate it.
They have also decided that, on the plans, the new support pillars should be able to form a parallelogram

Plot the new location of the supporting pillar and write its coordinates. Label it $\mathbf{C}_{1}$.

Use the definition or properties of a parallelogram to verify that the new layout is a parallelogram. You must use the slopes of the sides, the lengths of the lines or both to verify your answer.


JCHL


A monorail similar to the one shown was planned for an amusement arcade.
The original plans had the supports located as shown on the grid below.
$A(7,12) \quad B(9,2) \quad C(15,1) \quad D(3,5)$


2 pains of 11 sides
Opposite sides equal in learn

Use the definition or properties of a parallelogram to verify that the new layout is a parallelogram. You must use the slopes of the sides, the lengths of the lines or both to verify your answer.

## Task 13: JCHL

Linda Armstrong is a professional forester.
In order to calculate how much wood is in a forest she must measure the height of the trees.


We don't count and measure every tree in the forest. That would simply take too long.

Foresters measure a few bits of the forest and, on the basis of those bits, estimate what the whole forest contains

Suggest a way that Linda could choose which "bits" to sample.
$\square$

Foresters need to monitor the growth of trees. They measure their heights each year and can determine the yearly tree growth.


Linda used this technique and obtained the measurements in the table

| Angle A | $55^{\circ}$ |
| :--- | :--- |
| Angle B | $25^{\circ}$ |
| Distance from Linda <br> to Tree | 2.5 m |



Use trigonometry to calculate the height of the tree.


Linda wanted to compare the growth of trees on a tree farm with the growth of trees in a forest. The stem and leaf plot shows the yearly growth, in cm, of a selection of trees in both the tree farm and the forest.

Tree Farm
Forest

| 1 | 1 | 013 |
| ---: | :--- | :--- |
| 33 | 2 | 157 |
| 721 | 3 | 013899 |
| 980 | 4 | 23448 |
| 10 | 5 | 0137 |

$2 \mid 5=25 \mathrm{~cm}$
$1|5|=51 \mathrm{~cm}$

What is the difference between the median yearly growth in cm of the selection of trees from the forest and those from the tree farm?


Is there any evidence to suggest that the trees on the farm grow quicker than the trees in the forest?


## Task 14: JCFL

Mark's house is located near the perimeter fence of his school playing field.

## School.Entrance



180m

Path 1: $\qquad$ Path 2 —.....

Fence $\qquad$

There are two paths Mark can take to school. He can walk along the fence, go through the gate to the playing field and walk across the field (Path 1), or walk around the perimeter fence (Path 2).

What is the difference in distance between the two paths?


## Task 15: JCOL

In the diagram below, line segments $C F$ and $B E$ intersect at $A$.
Is $\triangle \mathrm{AEF}$ similar to $\triangle \mathrm{ACB}$ ?


Give a reason for your answer.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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Calculate the lengths AF, AC and CB.


## Task 16: JCOL

Jack placed a 4m ladder in a laneway between two buildings
Building 1

When he tilted the ladder one way it reached 2.5 m up the wall of building 1 and when tilted the other way it reached 1.5 m up the wall of building 2 .

What is the width of the laneway?


## Task 17: JCOL

A surveyor wants to determine the distance across a lake.
She is unable to make the measurements directly.


She will use triangles ADE and ACB.
Explain why, in geometric terms, triangles ADE and ACB are similar.


Create a ratio that can be used to find the distance $x$ across the lake. Use this ratio and the measurements given in the diagram to calculate x , the distance across the lake.
$\qquad$

## Task 18: JCHL

A surveyor wants to determine the distance across a lake.
She is unable to make the measurements directly.


Suggest some measurements she could make and how she could use these to determine the distance across the lake.


## Task 19: JCHL

The JCDecaux advertising agency sought a building that was tall enough to accommodate an 18m high rectangular billboard.
An employee of the company thought he had found a building that would work. He is 2 m tall and, on the morning he examined the building, he cast a shadow 0.5 m long. The building cast a shadow 4 m long.

Determine whether or not the building will accommodate the billboard.


