

OCDSB IB Mathematics Exercise

For the mathematics component of your IB application, you are asked to complete a set of problems on any **ONE** of the following four strands of mathematics:

1) Measurement; 2) Number; 3) Patterning and Algebra; or 4) Geometry and Spatial Sense

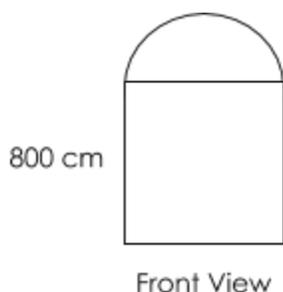
For us to be able to assess your ability and potential in math accurately, it is very important that you answer the questions thoroughly. For all questions on this test, please give full solutions taking special care to present your work in an organized and easy to follow fashion. Please communicate your thinking as clearly as possible. See the attached exemplar with a quality full solution for guidance.

Please choose **1** of the following 4 strands to complete and submit with your IB application. Your solutions should be **handwritten** and uploaded as either a PDF or image file. Please do not submit more than one strand as only the first **one** will be marked.

Measurement

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The shape below is a sign made from a semi-circle and a rectangle.



- The sign's width is 60% of the height. What would the sign's perimeter be?
- The sign is actually 3-Dimensional and has a depth of $\frac{2}{5}$ th the width. Draw and label the side view of the sign with as many measurements as possible.
- One can of spray paint costs \$10.59 before Ontario sales tax and covers 20 **square metres**. How much would it cost to paint the entire surface of the sign?
- Describe multiple ways you could create other right prisms that have the same volume as this sign.

Number

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a. Abed goes to a mall to buy gifts for his relatives. He sees a sign advertising socks at \$5 per pair - buy 2 pairs and get the third pair for free. Abed decides to buy a pair of socks for each of his 30 favourite relatives. How much does Abed spend?

b. After leaving the sock store, Abed sees a beautiful shirt at the shirt store that he must have. It costs \$40, but it is discounted at 20% off and then a 13% sales tax is added. The cashier, by mistake, applies the tax first and then the discount. Does this affect how much Abed spends?

c. Because Abed is the ten-thousandth customer at the mall, he receives a prize of an unknown number of candies. He gives one-third of them to his younger sister. He then eats one-fourth of the remaining candies and then he divides the rest among his 5 best friends. Each friend receives 3 candies. How many candies did he receive as a prize?

d. When Abed gets home, he looks in his own sock drawer and notices that he has 2 pairs of striped socks and 8 pairs of green socks (and no others). He really likes the striped socks. How many more pairs of striped socks must Abed buy so that if he closes his eyes and reaches into the sock drawer he will have a two-thirds chance of picking a striped pair?

e. Abed decides to go back to the mall before it closes to buy some more striped socks. He checks his watch and it is exactly 3:21:56. Distracted by his love of math, Abed realizes he can take the first four numbers on his watch (3, 2, 1, 5) and create a numeric expression equal to the last number (6) in multiple ways. Here are some that Abed came up with:

$$2 \times 5 - 3 - 1 = 6, \quad (3 - 2)(5 + 1) = 6, \quad \frac{5 - 1}{2} \cdot 3 = 6, \quad (5 + 3 - 2)^1 = 6$$

After working on this a while, he checks the time again (3:42:12) and heads to the mall. Try and find multiple ways to use all four of the numbers 3, 4, 2 and 1 and the operations you have learned to create a numeric expression equal to 2.

Patterning & Algebra

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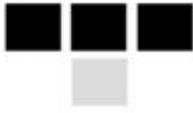


Figure 1

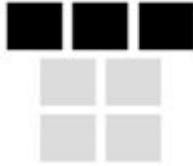


Figure 2



Figure 3

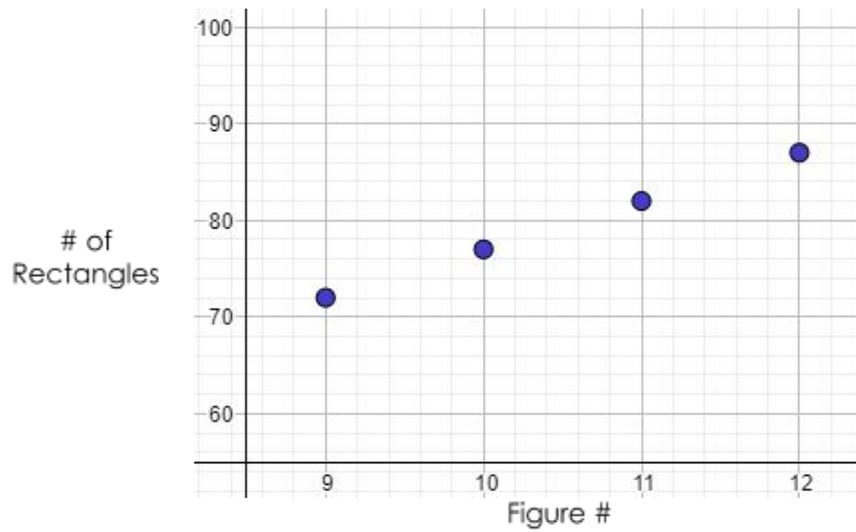
Figure 4

- Draw **Figure 4**.
- Explain a rule** you could use to calculate the number of rectangles in **each of the next figures**.
- Use your **rule** to complete the **table of values**.

Figure #	# of Rectangles
0	
1	
2	
3	
4	
5	
6	

- Write an algebraic expression that describes the pattern sequence.

The above pattern continues until the 8th figure. The pattern then changes and the 9th figure onwards uses the pattern shown below.

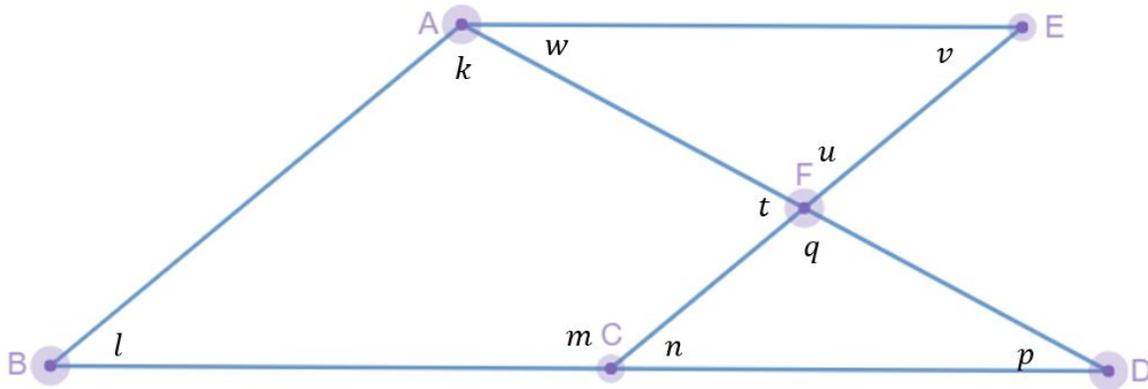


- e. Find the number of rectangles in **Figure 15**.
- f. Describe the rule for the entire pattern. That is, describe the patterns rules from figure 1 onward.
- g. Hafsa says **Figure 7** and **Figure 15** have 144 rectangles all together. Explain how Hafsa may have arrived at their solution.
- h. Which **Figure** has 317 rectangles?

Geometry and Spatial Sense

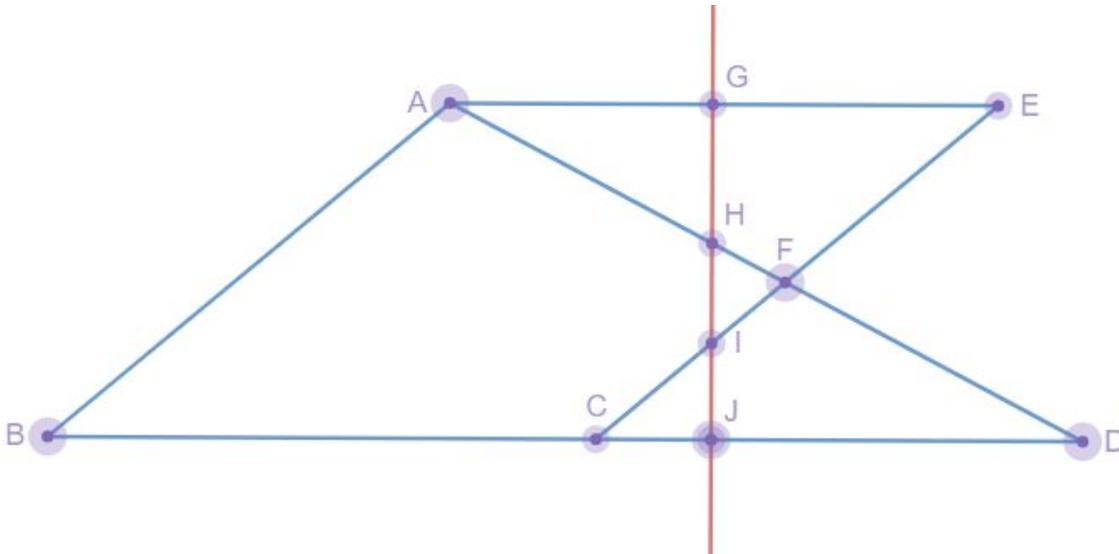
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Figure 1 below has two sets of parallel lines. Line AE is parallel to line BD, and Line AB is parallel to line CE.



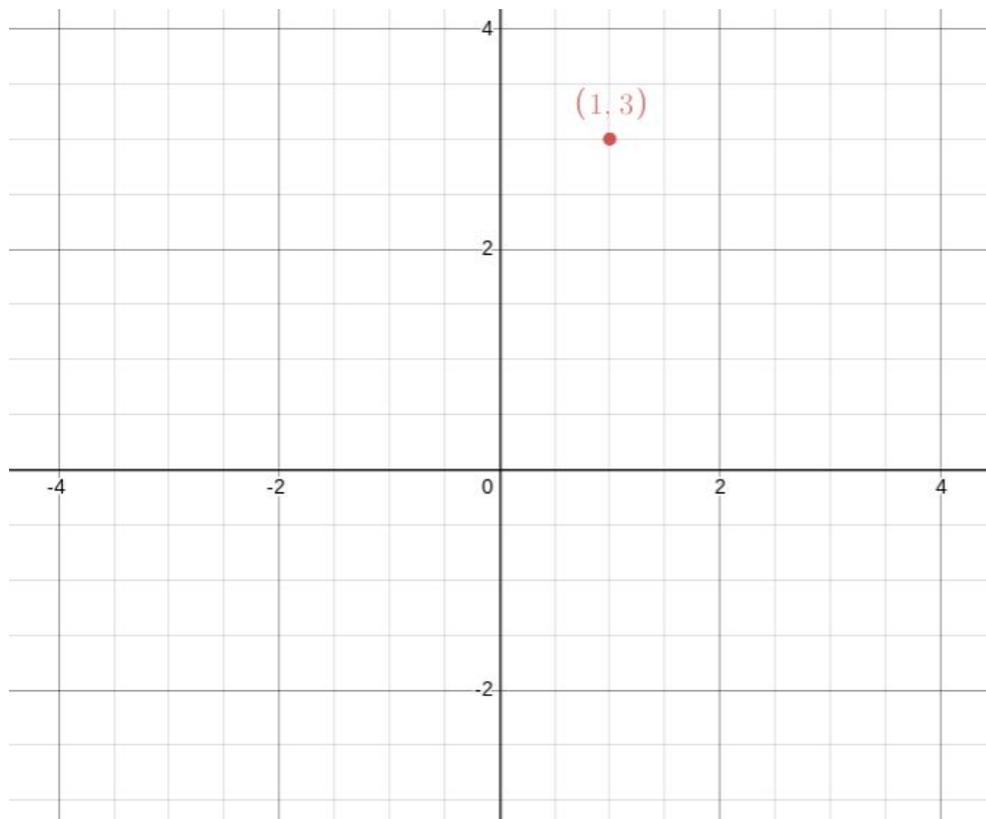
- Given that angle $\angle l = 40^\circ$ and $\angle q = 112^\circ$, find as many of the interior angles as possible. Explain all your reasoning.
- Identify any similar triangles in this shape.

Figure 2 below has a red line that cuts through the same shape from Figure 1, and therefore creates points G, H, I, and J.



- What are the additional similar shapes that have been created? Explain your reasoning.

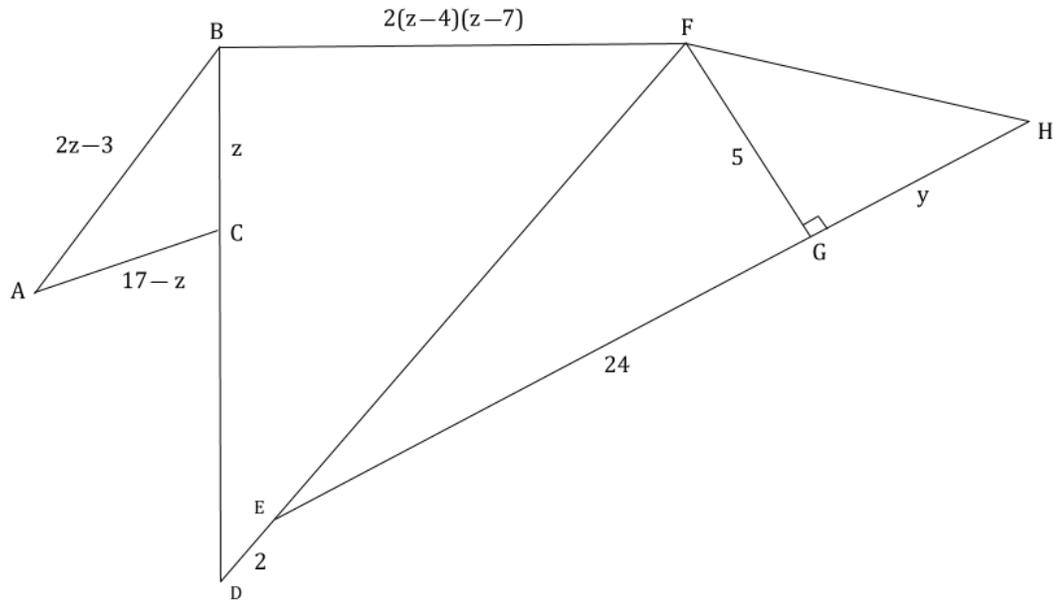
- d. An isosceles triangle has one vertex at $(1, 3)$ on a Cartesian plane (shown in Figure 3). Vertex $(1,3)$ is the top vertex. Describe multiple ways where you might find the other two vertices in the diagram.



Exemplar

Given the following information **find the perimeter of the figure below (not drawn to scale).**

- Area of $\triangle EFH = 90\text{cm}^2$
- Perimeter of $\triangle ABC = 30\text{cm}$
- Side BC and side CD have a length ratio of 2:3.



To find the perimeter of the shape above we will need to find the length of each external side.

Area of $\triangle EFH$

Area of a triangle relies on the base and the height as the formula below shows.

$$A = \frac{bh}{2}$$

Since $A = 90$ and $h = 5$

$$90 = \frac{b \times 5}{2}$$

$$90 = b \times 2.5$$

$$\frac{90}{2.5} = \frac{b \times 2.5}{2.5}$$

$$36 = b$$

The base of the entire triangle is 36 so to find y , we can subtract 24 from 36.

$$y = 12$$

So side EH is 36

Side FH

In order to find side FH we can use Pythagorean theorem since FH is the hypotenuse of $\triangle GFH$.

$$c^2 = a^2 + b^2$$

$$FH^2 = 5^2 + 12^2$$

$$FH^2 = 25 + 144$$

$$FH^2 = 169$$

$$FH = \sqrt{169}$$

$$FH = 13$$

Perimeter of $\triangle ABC$

Perimeter is the sum of all the sides for a triangle and since the perimeter is 30 cm,

$$30 = (2z - 3) + (17 - z) + (z) \quad - \text{Adding all the sides}$$

$$30 = 2z + 14$$

$$30 - 14 = 2z + 14 - 14$$

$$16 = 2z$$

$$\frac{16}{2} = \frac{2z}{2}$$

$$8 = z$$

$$\text{Side } BC = 8$$

$$AB = 2(8) - 3$$

$$AB = 13$$

$$AC = 17 - (8)$$

$$AC = 9$$

Side BF

$$BF = 2(8 - 4)(8 - 7)$$

$$BF = 2(4)(1)$$

$$BF = 8$$

Now all external sides have been calculated except for the side CD. To find the side CD we can use the ratio BC:CD.

$$BC = 8$$

The ratio is 2:3, which can be written as 8:12. Since BC = 8, this makes CD = 12.

$$CD = 12$$

Now that all external sides have been calculated, we can calculate the perimeter.

$$P = AB + BF + FH + HG + GE + ED + DC + CA$$

$$P = 13 + 8 + 13 + 12 + 24 + 2 + 12 + 9$$

Therefore the perimeter of the figure is 93 cm.