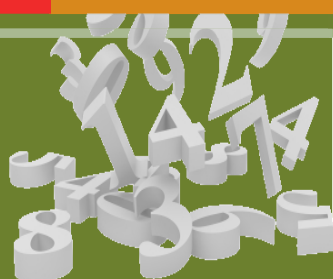


# NUMERACY:

## The Basics Workbook



### Set S: Geometry 1 Perimeter

Companion Workbook to Numeracy: The Basics Video Series

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For more information,  
visit [www.wem.mb.ca](http://www.wem.mb.ca)  
or contact the Project Coordinator  
Lindsay Laidlaw at [info@wem.mb.ca](mailto:info@wem.mb.ca)

Workplace Education Manitoba  
1000 Waverley Street  
Winnipeg, MB, R3T 0P3

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# ACKNOWLEDGMENTS





## INTRODUCTION

### What is Numeracy: The Basics Workbook?

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This workbook is intended to accompany Workplace Education Manitoba's (WEM) Numeracy: The Basics Video Series, a set of 50 videos that explain essential numeracy concepts.

The refresher videos cover 25 critical numeracy topics, each broken into concept and practice.

The video series and accompanying downloadable workbooks can be found at [http://www.wem.mb.ca/learning\\_on\\_demand.aspx](http://www.wem.mb.ca/learning_on_demand.aspx)

These Numeracy: The Basics workbooks provide an opportunity for additional skill-building practice.

### Numeracy: The Basics topics are:

- Order of Operations 1
- Order of Operations 2
- Adding & Subtracting Fractions 1
- Adding & Subtracting Fractions 2
- Multiplying & Dividing Fractions
- Mixed & Improper Fractions
- Operations with Mixed Fractions 1
- Operations with Mixed Fractions 2
- Operations with Mixed Fractions 3
- Adding & Subtracting Decimals
- Multiplying Decimals
- Dividing Decimals
- Order of Operations & Decimals
- Decimals, Fractions & Percent 1
- Decimals, Fractions & Percent 2
- Imperial Conversions
- Metric Conversions
- Metric and Imperial Conversions
- Geometry 1 – Perimeter
- Geometry 2 – Area
- Geometry 3- Volume
- Solving Equations 1
- Solving Equations 2
- Ratio & Proportion
- Averages



## GEOMETRY 1 PERIMETER

This workbook contains five skill-building practice sections. Solutions can be found at the end of the workbook.

### Practice Section A

Solve the following. Round each answer to two decimal places, if rounding is necessary. Note that diagrams are not drawn to scale.

1. Define and give an example of perimeter.

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2. Find the perimeter of a square with each side measuring 2 in.

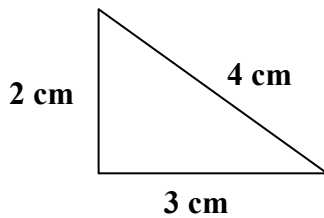
3. Find the perimeter of a rectangle with a length of 2 m and a width of 1 m.

4. Find the perimeter of a circle with a radius of 5 cm.

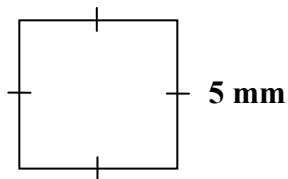


5. Find the perimeter of a triangle with sides measuring 2 ft, 5 ft, and 6 ft.

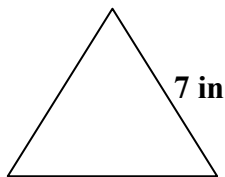
6. Find the perimeter of the object in the diagram below.



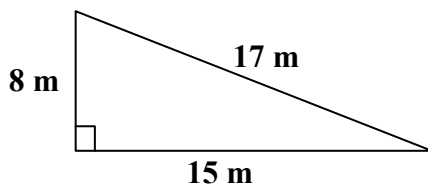
7. Find the perimeter of the square drawn below.



8. Find the perimeter of the equilateral triangle (where all sides have the same measure) drawn below.

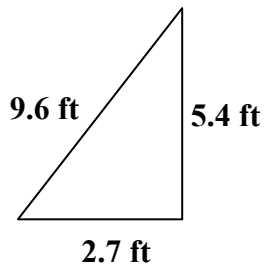


9. Find the perimeter of the triangle in the diagram below.

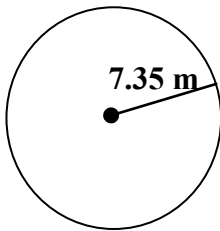




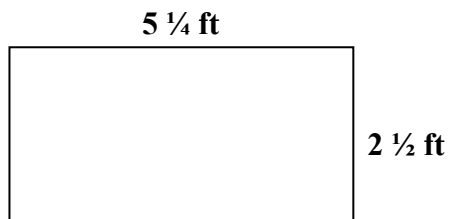
10. Find the perimeter of the triangle in the diagram below.



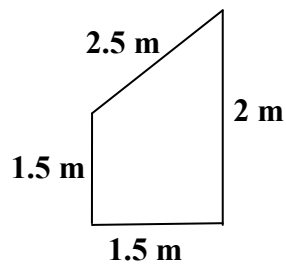
11. Find the perimeter of the circle in the diagram below.



12. Find the perimeter of the rectangle in the diagram below.

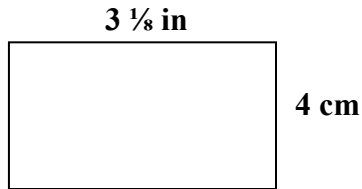


13. Find the perimeter of the object drawn in the diagram below.





14. Find the perimeter of the rectangle drawn in the diagram below.



15. Find the perimeter of a circle, in meters, that has a diameter of 6 in.

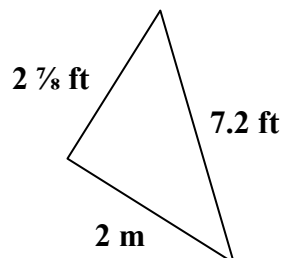
### Practice Section B

Solve the following. Round each answer to two decimal places, if rounding is necessary. Note that diagrams are not drawn to scale.

1. Find the perimeter of a rectangle, in feet, that has a length of 3.5 ft and a width of 38 in.

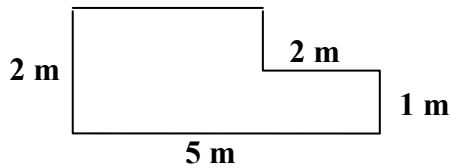
2. Find the perimeter of a square that has a side length of  $2\frac{7}{8}$  in.

3. Find the perimeter of the triangle drawn in the diagram below.

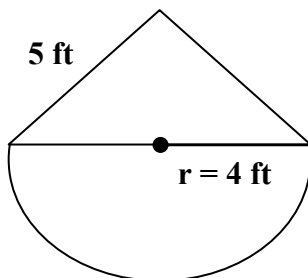




4. Find the perimeter of the figure drawn below.



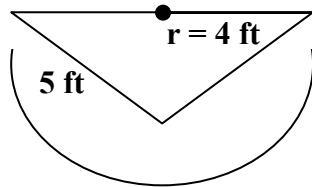
5. Find the perimeter of an equilateral triangle with side lengths equal to  $3\frac{5}{8}$  in.
6. If the length of a rectangle is 4 m and the perimeter is 12 m, what is the width of the rectangle?
7. The perimeter of a triangle is 15 in. Two of the sides measure 3 in and 8 in. What is the length of the third side of the triangle?
8. An isosceles triangle has equal sides measuring 5 ft, and a longer side of 8 ft. This triangle is capped with a semi-circle that has a radius of 4 ft. Find the perimeter of the entire object.





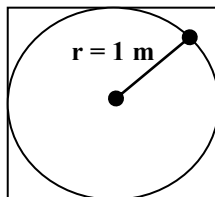


9. Consider the same diagram as in question 8. What would the perimeter of the object be if the triangle was 'flipped' as in the diagram below?



10. How many equilateral triangles, having a side length of 4 ft can fit in a rectangle that is 4 ft wide and 20 ft long?
11. Find the radius of a circle that has a circumference of 56.52 m.

12. A circle having a radius of 1 m is drawn inside a square as in the diagram below.

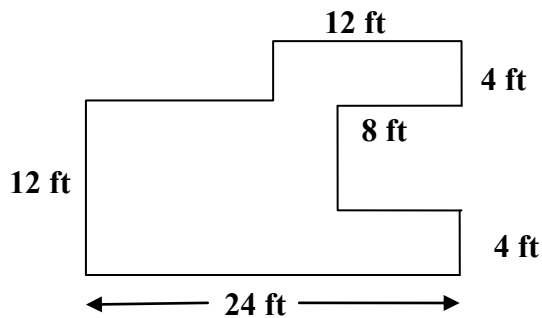


What is the perimeter of the square?

13. A rectangle has a length of 9 cm and a width of 5 cm. What is the length of the largest square that has the same perimeter as the rectangle?



14. Calculate the perimeter of the figure drawn below.

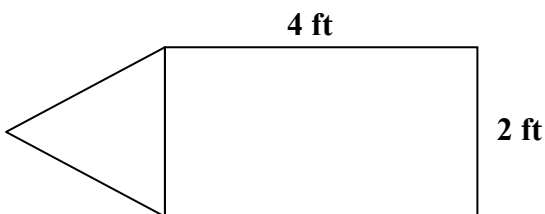


15. The radius of a circle is 10 cm. What is the side length of the equilateral triangle that has the same perimeter as the circle?

**Practice Section C**

Solve the following. Round each answer to two decimal places, if rounding is necessary. Note that diagrams are not drawn to scale.

1. An isosceles triangle is placed at one end of a rectangle as in the diagram below.

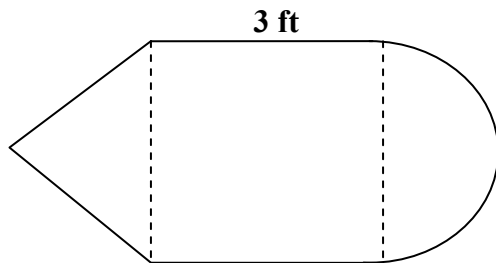


Find the perimeter, in meters, of the figure.

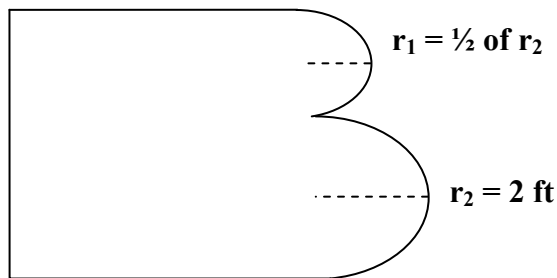
2. Consider the triangle in question 2. How many isosceles triangles will exactly fit into a rectangle that measures 15.75 cm by 26.25 cm?



3. A square is capped by an equilateral triangle at one end and a semi-circle at the other as in the diagram below. If the side length of the square is 3 ft, what is the perimeter of the entire figure?



4. Consider the square with two semi-circular pieces added on as in the diagram below. The larger semi-circle has a radius of 2 ft, which is twice the radius of the smaller semi-circle. Find the perimeter of the object.



5. An isosceles triangle has a perimeter of 17.9246212 cm. The triangle has two equal sides and one longer side. The longer side measures 7.4246212 cm. What would be the perimeter of an 8 cm square capped with one of these isosceles triangles at each end?

**Practice Section D**

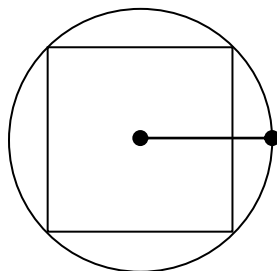
In this section, solutions for the practice questions contain commonly-made errors. For each question, circle the error(s) and give a correct solution.

There are 4 individual pieces of rope that are each 12 ft long. Using each piece of rope, Sam says that it is impossible to make the following shapes so that they all have the same perimeter: 1 equilateral triangle, 1 rectangle, 1 square and 1 circle. Lori says that Sam is incorrect because she was able to physically make all the shapes herself. Which one of them is correct? Explain your reasoning.

**Practice Section E**

Challenge Question. If you can do this one, then you get an A<sup>+</sup>. 😊

A square is inscribed (inside) in a circle as in the diagram below. Calculate the perimeter of the square if the circumference of the circle measures  $4\pi$  meters.





# SOLUTIONS

## Set S

### Geometry 1 Perimeter



## GEOMETRY 1 PERIMETER

### Practice Section A

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- 1.** Solution:  
Perimeter is a measurement of the total distance around an object.  
Example: to find the perimeter of a 5-sided figure, add up the lengths of all 5 sides.
- 2.** Solution:  
Since a square has 4 equal sides, the perimeter is  $2 + 2 + 2 + 2 = 8$  in. A formula that can be used to find the perimeter is  $P = 4s$ , where 's' is the side length of the square and P is the perimeter.
- 3.** Solution:  
The perimeter of a rectangle is found by adding two times the length and two times the width. The perimeter is  $2 + 1 + 2 + 1 = 6$  m. A formula that can be used to calculate the perimeter of a rectangle is  $P = 2l + 2w$ , where 'l' is the length and 'w' is the width.
- 4.** Solution:  
The perimeter of a circle is called the circumference. The equation for the circumference 'C' of a circle is  $C = 2 \times \pi \times r$  or  $C = \pi \times d$ . An approximation for  $\pi$  that can be used is  $\pi = 3.14$ . This will give a perimeter of:

$$\begin{aligned}C &= 2 \times \pi \times r \\&= 2 \times \pi \times 5 \\&= 10\pi \\&= 10 \times 3.14 \\&= 31.4 \text{ cm}\end{aligned}$$

- 5.** Solution:  
To find the perimeter of the triangle, we add the length of all three sides. The perimeter could be represented by the formula  $P = s_1 + s_2 + s_3$ , where 's' is the side length. The perimeter of this triangle is:

$$\begin{aligned}P &= s_1 + s_2 + s_3 \\&= 2 + 5 + 6 \\&= 13 \text{ ft}\end{aligned}$$



6. Solution:

$$\begin{aligned}P &= s_1 + s_2 + s_3 \\ &= 2 + 3 + 4 \\ &= 9 \text{ cm}\end{aligned}$$

7. Solution:

$$\begin{aligned}P &= s + s + s + s & P &= 4s \\ &= 5 + 5 + 5 + 5 & \text{or} & = 4 \times 5 \\ &= 20 \text{ mm} & & = 20 \text{ mm}\end{aligned}$$

8. Solution:

$$\begin{aligned}P &= s + s + s & P &= 3s \\ &= 7 + 7 + 7 & \text{or} & = 3 \times 7 \\ &= 21 \text{ in} & & = 21 \text{ in}\end{aligned}$$

9. Solution:

$$\begin{aligned}P &= s_1 + s_2 + s_3 \\ &= 8 + 17 + 15 \\ &= 40 \text{ m}\end{aligned}$$

10. Solution:

$$\begin{aligned}P &= s_1 + s_2 + s_3 \\ &= 9.6 + 5.4 + 2.7 \\ &= 17.7 \text{ ft}\end{aligned}$$

11. Solution:

$$\begin{aligned}C &= 2 \times \pi \times r \\ &= 2 \times \pi \times 7.35 \\ &= 2 \times 3.14 \times 7.35 \\ &= 6.28 \times 7.35 \\ &= 45.9696 \\ &= 45.97 \text{ m}\end{aligned}$$



12. Solution:

$$\begin{aligned}
 P &= 2l + 2w \\
 &= 2 \times \left(5\frac{1}{4}\right) + 2 \times \left(2\frac{1}{2}\right) \\
 &= 2 \times \left(\frac{21}{4}\right) + 2 \times \left(\frac{5}{2}\right) \\
 &= \frac{42}{4} + \frac{10}{2} \left(\frac{2}{2}\right) \\
 &= \frac{42}{4} + \frac{20}{4} \\
 &= \frac{62}{4} = \frac{31}{2} = 15\frac{1}{2} \text{ ft}
 \end{aligned}$$

13. Solution:

The perimeter of this object is found by adding the lengths of all the sides. The formula that will give the correct perimeter is  $P = s_1 + s_2 + s_3 + s_4$ .

$$\begin{aligned}
 P &= s_1 + s_2 + s_3 + s_4 \\
 &= 1.5 + 2.5 + 1.5 + 2 \\
 &= 7.5 \text{ m}
 \end{aligned}$$

14. Solution:

First we need to convert the units. All measurements must be in either inches or centimeters. The solution is:

$$\begin{aligned}
 P &= 2l + 2w \\
 &= 2 \left(3\frac{1}{8} \text{ in}\right) + 2(4 \text{ cm}) \\
 &= \cancel{2} \left(\frac{25}{(4)\cancel{8}} \text{ in}\right) + 8 \cancel{\text{cm}} \times \frac{1 \text{ in}}{2.54 \cancel{\text{cm}}} \\
 &= \frac{25}{4} \text{ in} + \frac{8}{2.54} \text{ in} \\
 &= 6.25 \text{ in} + 3.14961 \text{ in} \\
 &= 9.3996 \text{ in} \\
 &= 9.40 \text{ in}
 \end{aligned}$$

or

$$\begin{aligned}
 P &= 2l + 2w \\
 &= 2 \left(3\frac{1}{8} \text{ in}\right) + 2(4 \text{ cm}) \\
 &= \cancel{2} \left(\frac{25}{(4)\cancel{8}} \text{ in}\right) + 8 \text{ cm} \\
 &= \frac{25}{4} \cancel{\text{in}} \times \frac{2.54 \text{ cm}}{1 \cancel{\text{in}}} + 8 \text{ cm} \\
 &= 15.875 \text{ cm} + 8 \text{ cm} \\
 &= 23.875 \text{ cm} \\
 &= 23.88 \text{ cm}
 \end{aligned}$$





15. Solution:

If the diameter of the circle is 6 inches, then the radius is half of that, which will be 3 inches.

$$\begin{aligned}C &= 2 \times \pi \times r \\&= 2 \times \pi \times 3 \\&= 6\pi \\&= 6 \times 3.14 \\&= 18.84 \text{ in}\end{aligned}$$

Now convert 18.84 in to meters.

$$\begin{aligned}&= 18.84 \cancel{\text{ in}} \times \frac{2.54 \cancel{\text{ cm}}}{1 \cancel{\text{ in}}} \times \frac{1 \text{ m}}{100 \cancel{\text{ cm}}} \\&= 0.4785 \text{ m} \\&= 0.48 \text{ m}\end{aligned}$$

### Practice Section B

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1. Solution:

$$\begin{aligned}P &= 2l + 2w \\&= 2 \times 3.5 \text{ ft} + 2 \times 38 \cancel{\text{ in}} \times \frac{1 \text{ ft}}{12 \cancel{\text{ in}}} \\&= 7 \text{ ft} + 6.\bar{3} \text{ ft} \\&= 13.\bar{3} \text{ ft} \\&= 13.33 \text{ ft}\end{aligned}$$

2. Solution:

$$\begin{aligned}P &= 4s \\&= 4 \times 2\frac{7}{8} \\&= \cancel{4} \times \frac{23}{\cancel{(2)}\cancel{8}} \\&= \frac{23}{2} = 11.5 \text{ in}\end{aligned}$$

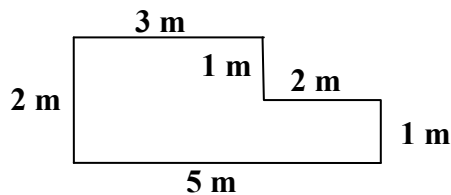


3. Solution:

$$\begin{aligned}P &= s_1 + s_2 + s_3 \\&= 2\frac{7}{8}ft + 7.2ft + 2m \\&= 2\frac{7}{8}ft + 7.2ft + 2\cancel{m} \times \frac{100\cancel{cm}}{1\cancel{m}} \times \frac{1\cancel{in}}{2.54\cancel{cm}} \times \frac{1ft}{12\cancel{in}} \\&= 2.875ft + 7.2ft + 6.5616ft \\&= 16.6366ft \\&= 16.64ft\end{aligned}$$

4. Solution:

The two missing side lengths are 3 m and 1 m.



Adding up the lengths of all the sides:

$$P = 5 + 1 + 2 + 1 + 3 + 2$$

$$P = 14m$$

5. Solution:

$$P = 3s$$

$$= 3 \times 3\frac{5}{8}$$

$$= 3 \times \frac{29}{8}$$

$$= \frac{87}{8}$$

$$= 10\frac{7}{8}in = 10.875in$$



6. Solution:

There are 2 lengths and 2 widths that must equal 12 m. If one length is 4 m, then 2 lengths are 8 m. This leaves  $12m - 8m = 4m$  for two widths. Each width must then be 2 m.

7. Solution:

$$P = s_1 + s_2 + s_3$$

$$15 = 3 + 8 + s_3$$

$$15 = 11 + s_3$$

$$s_3 = 4 \text{ in}$$

8. Solution:

The triangle has two sides of 5 ft.

The circumference of the circle is:

$$C = 2 \times \pi \times r$$

$$= 2 \times \pi \times 4$$

$$= 8\pi$$

$$= 25.12 \text{ ft}$$

Since we only have a semi-circle, the circumference must be divided by 2. Therefore,  $25.12 \div 2 = 12.56 \text{ ft}$ .

The circumference of the semi-circle, plus the two side lengths of 5 ft, will give a perimeter of:

$$P = 12.56 + 5 + 5$$

$$= 22.56 \text{ ft}$$

9. Solution:

The perimeter of this object is the circumference of the semi-circle plus the longer side of the triangle.

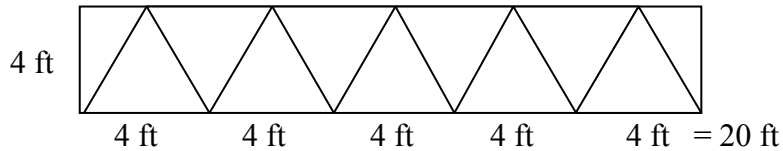
$$P = 12.56 + 8$$

$$= 20.56 \text{ ft}$$



10. Solution:

There would be 9 full equilateral triangles + 2 half triangles.  
See the diagram below.



11. Solution:

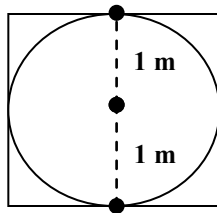
$$C = 2 \times \pi \times r$$

$$56.52 = 6.28 \times r$$

$$r = 9m$$

12. Solution:

If the square is inside the circle, then its side length must be the same as the diameter of the circle. Since the radius is 1 m, the diameter is 2 m.



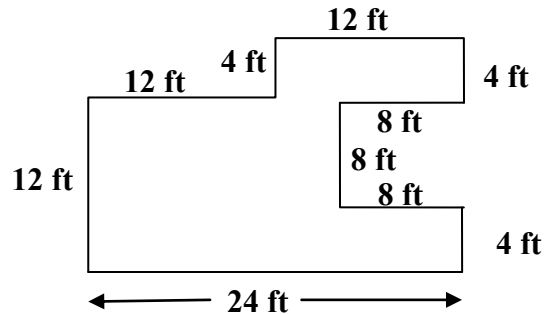
Therefore the side lengths of the square are each 2 m, making the perimeter equal  $2 + 2 + 2 + 2 = 8m$ .

13. Solution:

The rectangle has sides of 5 cm and 9 cm, and therefore the perimeter is  $2 \times 5 + 2 \times 9 = 10 + 18 = 28$  cm. Because a square has 4 equal sides, we must divide the perimeter by 4. Therefore, each side must be  $28 \div 4 = 7$  cm.



14. Solution:  
First we must determine the missing side lengths.



Starting at the top right corner and moving counter-clockwise, the perimeter is:

$$P = 12 + 4 + 12 + 12 + 24 + 4 + 8 + 8 + 8 + 4$$

$$P = 96 \text{ ft}$$

15. Solution:  
If the radius of the circle is 10 cm, then:

$$C = 2 \times \pi \times r$$

$$= 2 \times \pi \times 10$$

$$= 20 \times \pi$$

$$= 62.8 \text{ cm}$$

If the perimeters are to be the same, then the side length of the equilateral triangle is

$$\frac{62.8}{3} = 20.93 \text{ cm.}$$

**Practice Section C**

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1. Solution:

Since the triangle is isosceles and the width of the rectangle is 2 ft, the side length of the triangle must also be 2 ft. Adding two sides of the triangle, and one width and two lengths of the rectangle gives

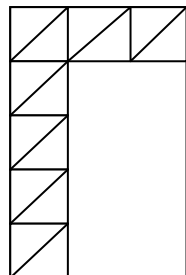
$$\begin{aligned}P &= 2l + w + 2 \times s \\&= 2 \times 4 + 2 + 2 \times 2 \\&= 8 + 2 + 4 \\&= 14 \text{ ft}\end{aligned}$$

Now convert 14 ft to meters.

$$\begin{aligned}&= 14 \cancel{\text{ft}} \times \frac{12 \cancel{\text{in}}}{1 \cancel{\text{ft}}} \times \frac{2.54 \cancel{\text{cm}}}{1 \cancel{\text{in}}} \times \frac{1 \text{ m}}{100 \cancel{\text{cm}}} \\&= 4.2672 \text{ m} \\&= 4.27 \text{ m}\end{aligned}$$

2. Solution:

Dividing the length and the width each by 5.25 will give the number of isosceles triangles along each side.  $\left( \frac{15.75}{5.25} = 3, \frac{26.25}{5.25} = 5 \right)$  The rectangle is 3 triangles wide and 5 triangles long. This would give a pattern looking like the following diagram:



Therefore, there are 6 triangles in one row and since there are 5 rows, there would be  $6 \times 5 = 30$  triangles.



## 3. Solution:

The fact that the center shape is a square tells us that the side lengths of the triangle are 3 ft, and therefore, so is the diameter of the circle. Adding two lengths of the square and two lengths of the triangle gives a total of 12 ft. Since we only have half a circle, half of the circumference needs to be added.

$$\begin{aligned}C &= \pi \times d \\&= 3.14 \times 3 \quad \frac{9.42}{2} = 4.71 \text{ ft} \\&= 9.42 \text{ ft}\end{aligned}$$

The total perimeter will be  $P = 12 + 4.71 = 16.71 \text{ ft}$ .

## 4. Solution:

The larger semi-circle has a radius of 2 ft and the smaller semi-circle has a radius of 1 ft. The question indicates that the main figure is a square with sides equal to the diameter of both circles. Since the circles have diameters of 4 ft and 2 ft (double the radii), the square must have a side length of 6 ft.

The total circumference of the two circles is:

$$\begin{aligned}C &= \pi \times d_{large} + \pi \times d_{small} \\&= 3.14 \times 4_{large} + 3.14 \times 2_{small} \\&= 12.56 + 6.25 \\&= 18.84 \text{ ft}\end{aligned}$$

Since these are both semi-circles, we must divide the total circumference by 2. Therefore,  $18.84 \div 2 = 9.42 \text{ ft}$ .

Three side lengths of the square need to be added to the total circumference of the two circles giving:

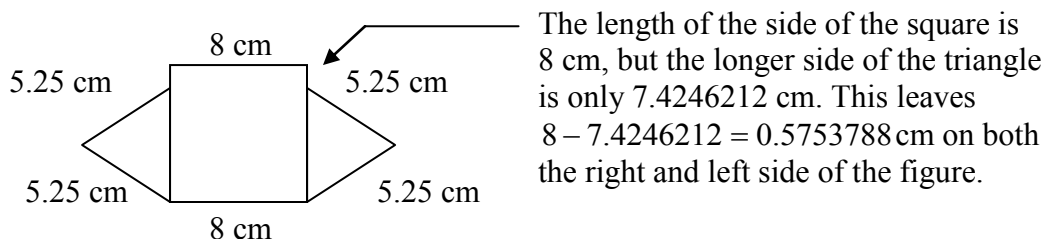
$$\begin{aligned}P_{total} &= P_{circles} + P_{square} \\&= 9.42 + 3 \times 6 \\&= 9.42 + 18 \\&= 27.42 \text{ ft}\end{aligned}$$



5. Solution:

Since the triangle is isosceles, the side length of the two equal sides is

$$17.9246212 - 7.4246212 = \frac{10.5}{2} = 5.25 \text{ cm. A diagram would look like:}$$



Therefore, the perimeter would be:

$$\begin{aligned} P &= 8 + 0.5753788 + 5.25 + 5.25 + 8 + 5.25 + 5.25 + 0.5753788 \\ &= 38.1507576 \\ &= 38.15 \text{ cm} \end{aligned}$$

### Practice Section D

1. Solution:

Lori is correct. The 4 pieces of 12 m rope can be shaped into any of the figures listed. The calculations are done below:

$$\begin{aligned} P_{\text{triangle}} &= s_1 + s_2 + s_3 \\ &= 4 + 4 + 4 \\ &= 12 \text{ ft} \end{aligned}$$

$$\begin{aligned} P_{\text{rect}} &= 2w + 2l \\ &= 2 \times 2 + 2 \times 4 \\ &= 4 + 8 \\ &= 12 \text{ ft} \end{aligned}$$

$$\begin{aligned} P_{\text{square}} &= 4s \\ &= 4 \times 3 \\ &= 12 \text{ ft} \end{aligned}$$

$$\begin{aligned} C &= \pi \times d \\ &= 3.14 \times 3.821656051 \\ &= 12 \text{ ft} \end{aligned}$$

Therefore, you could make an equilateral triangle with side lengths of 4 ft, a rectangle with a width of 2 ft and a length of 8 ft (other rectangles are possible), a square with side lengths of 3 ft and a circle with a diameter of 3.821656051 ft.

The key to this question is knowing that the perimeter/circumference of the shapes is 12 ft because that's the length of each piece of rope.



**Practice Section E**

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Solution:

If the circumference of the circle is  $4\pi$ , then :

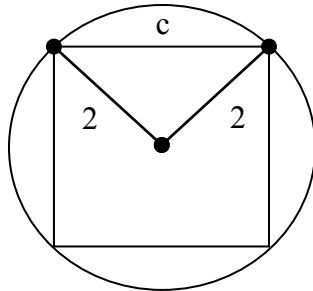
$$C = \pi \times d$$

$$4\pi = \pi \times d$$

$$4 = d$$

Given that the diameter of the circle is 4, then the radius is 2.

If two radii are connected to where the side of the square meets the circle, the following triangle is created:



Knowing that the diagonals of a square are perpendicular bisectors, we can use the Pythagorean theorem ( $a^2 + b^2 = c^2$ ) to solve for one side length of the square, where 'c' is the side length of the square.

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

$$r^2 + r^2 = c^2$$

$$2^2 + 2^2 = c^2$$

$$4 + 4 = c^2$$

$$8 = c^2$$

$$\sqrt{8} = c$$

Since there are 4 sides, the perimeter of the square is:

$$P = 4s$$

$$= 4 \times \sqrt{8}$$

$$= 11.3137085$$

$$= 11.31 \text{ units}$$

Although no units given in the question, we still need to include some sort of unit, hence the addition of the word "units."