Math 9 Lesson 5: Proportional Reasoning

- Spatial proportional reasoning
- Scale diagrams, similar triangles and polygons, linear unit conversions
- Limited to metric units
- Drawing a diagram to scale that represents an enlargement or reduction of a given 2D shape
- Solving a scale diagram problem by applying the properties of similar triangles, including measurements
- Integration of scale for First Peoples mural work, use of traditional design in current First Peoples fashion design, use of similar triangles to create longhouses / models

1. How many cm in 2 meters?

2. How many mm in a km?

3. How many inches in a mile given 1 mile = 5280 feet?

4. If a 10 cm long toy car is at a scale of 1:20 how long is the car in real life?

5. A right triangle has side lengths of 5-12-13.
   This triangle is enlarged by a factor of 2.
   a. Sketch these triangles

   b. What is the perimeter of the larger triangle?

   c. How many times larger is the area of the larger triangle vs. the smaller triangle?

6. A picture of the virus is 5 cm long. If the virus is 100 nanometers ("billionth")
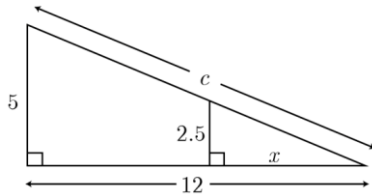   long in real life, what is the scale of this picture? (ex. 200:1, 1:2000, etc.)
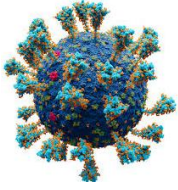
7. The following toy car is 6 cm wide:

   If the real racing car is 2 m wide, what is the scale factor?

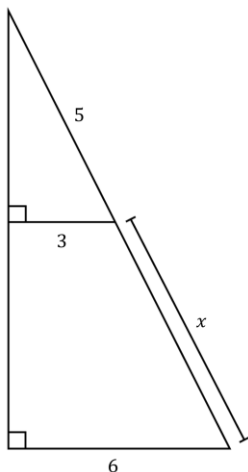8. Your toy plane is 5 cm wide. It is at a scale of $2:170$. How large is the plane in real life?
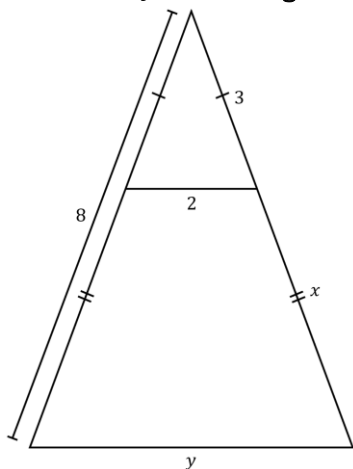
9. See triangle below:

   a. Find c

   b. Find x

10. Find x in the diagram below:
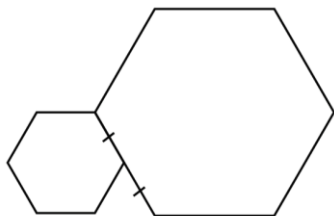

11. Find x and y in the diagram below:

12. The Burj Khalifa is about 830 m tall. The ruler measurement of a picture of this building is 6 cm. The ruler measurement of the picture of the monster is 2 cm.
    a. How tall is the monster in real life?

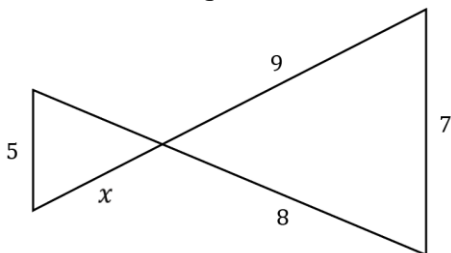   b. What assumption are you making when estimating the height of the monster?

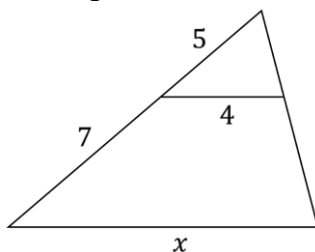13. The perimeter of the small hexagon in the diagram below is 12 m.

    a. Find the side length of the large hexagon.

    b. Express the perimeter of the smaller hexagon to the perimeter of the larger hexagon as a simplified ratio.

14. Find x in the diagram below:

15. See diagram below:

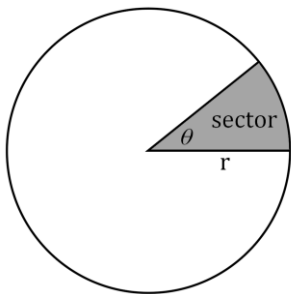   a. Under what conditions are the two triangles similar?
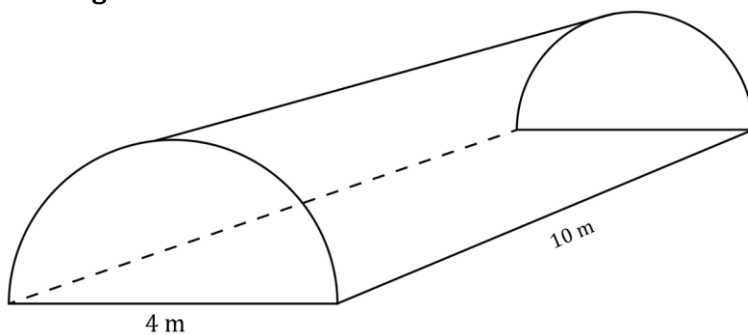
    b. Find x

16. Challenge 1:

360 degrees is equal to 2π radians. The formula for the circumference of a circle is $C = 2\pi r$ and the area of a circle is $A = \pi r^2$. Show that the arc length of a sector of a circle is $arc = \theta r$.

17. Challenge 2:

Why is the area of the sector below $A_{sector} = \dfrac{\theta r^2}{2}$?

18. Challenge 3: See the Pit House below:

10 m

4 m

a. How many times does the volume of the Pit House grow by doubling the dimensions?

b. How many times does the area of the Pit House grow by doubling the dimensions?

c. How large does the Pit House's area scale up by increasing the dimensions by a factor of n?

d. How large does the Pit House's volume scale up by increasing the dimensions by a factor of n?

e. Does this scaling ratio increase for all types of shapes?

19. Challenge 4:
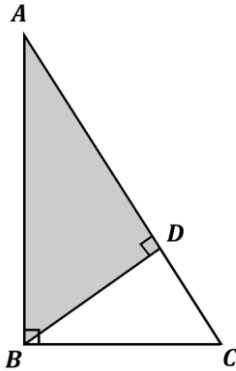
In $\triangle ABC$, $AB = 24$ and $BC = 10$. BD is $\perp$ to AC.
Find the ratio of the shaded area to the unshaded area.