PART A
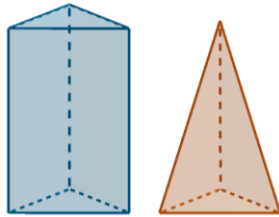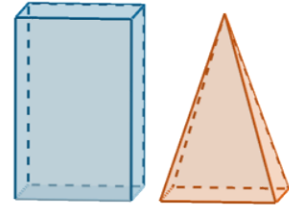
1) Describe the relationship between the volume of a prism and the volume of a pyramid with the same base shape and same height.

2) In the diagram on the right, the volume of the rectangular prism is 90 cm^3. Determine the volume of the pyramid (both solids have the same base and height).

3) In the diagram on the left, the pyramid has a volume of 12.5 m^3. Determine the volume of the prism (both solids have the same base and height).

4) Describe the relationship between the volume of a cylinder and the volume of a cone with the same base circle and height.

5) Find the volume of the cylinder shown on the right in cm^3. Use this information to find the volume of a cone that just fits inside.

9.5 cm

6.4 cm
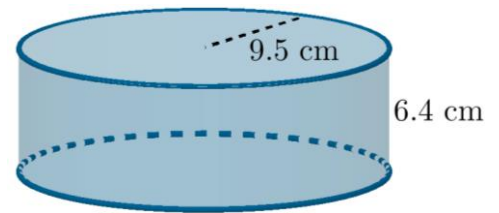
6) Find the volume of the cone shown on the left in m^3. Determine the volume of the cylinder that has the same base and height as this cone.

7) The two solids shown below have the same pentagonal base and the same height. If the volume of the prism is 26.75 cm^3, what is the volume of the pyramid to the nearest hundredth of a cubic cenimetre?

7 m

3 m
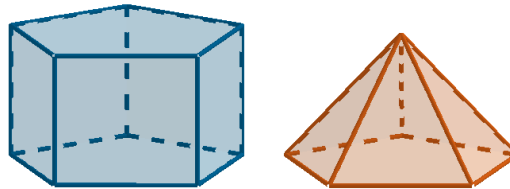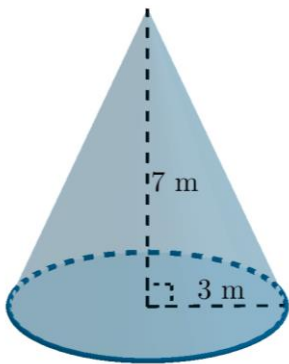
8) A rectangular prism has a volume of 280 cm^3. Determine the volume of a pyramid that has the same base and height as this rectangular prism. Round your answer to one decimal place.
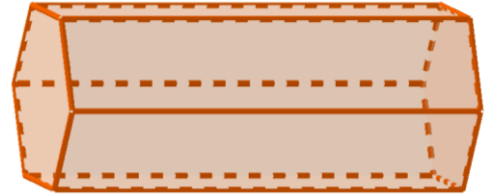
9) A square-based pyramid and a rectangular prism have the same base and height. If the pyramid has a volume of 56.25 mm^3, find the volume of the rectangular prism.

10) A conical party hat has a volume of 716.3 cm^3. The hat fits perfectly into a cylindrical storage case. Determine the volume of the case.

11) A company that manufactures paper drinking cups offers two options. One option is cylinder with a radius of 3 cm and a height of 10 cm and the other is an inverted cone. Both options have the same base and height dimensions. What is the volume of the cylindrical cup? Determine the volume of the conical option (cone)?

12) The shape of the box for a chocolate treat is a hexagonal prism, as shown on the right. Each box has a volume of 227 cm³. For Christmas, the company will switch to a festive box in the form of a hexagon-based pyramid. This festive box, which is intended to be stood upright and portray a Christmas tree, will have the same base and height as the standard prism packaging.
   a) Determine the volume of the festive box. Round your answer to two decimal places.
   b) If the treat usually costs $6.99, what would be a reasonable price for the festive version?

13) The formula for the volume of a cylinder with radius r and height h is $V = \pi r^2 h$.

   The volume of a cone with radius r and height h is given by $V = \frac{1}{3}\pi r^2 h$ or $V = \frac{\pi r^2 h}{3}$.

   a) Explain how the relationship between the volumes of cylinders and cones is evident in these formulas.
   b) A cylinder has a radius of 6 cm and a height of 14 cm. Use the formula to determine the volume of the cylinder and then use the relationship between cylinders and cones to find the volume of a cone with the same base and height.
   c) A cone has a diameter of 10.4 inches and a height of 4.5 inches. Use a formula to determine the volume of the cone and then use the relationship between cylinders and cones to find the volume of a cylinder with the same base and height.

14) The volume of a any prism can be found by multiplying the area of its base by its height.
   a) If the base of a triangular prism has an area of 68.2 m² and the height of the prism is 18.4 m, determine the volume of the triangular prism.
   b) Determine the volume of a triangle-based pyramid for which the area of the base is 68.2 m² and the height is 18.4 m. Round your answer to the nearest tenth of a cubic metre.
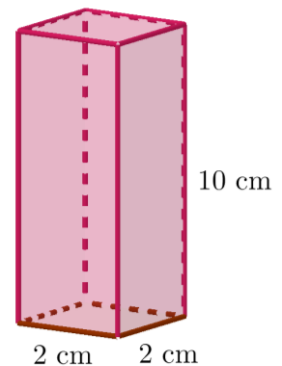
15) An ornament is shipped in the box shown on the right. The ornament is in the form of a square-based pyramid and its base is congruent to the base of the box. The height of the ornament is equal to the height of the box. Determine the volume of the ornament to the nearest hundredth of a cubic centimetre.

10 cm

2 cm   2 cm

16) A cylindrical container that has a volume of 7950 cm³ is filled with liquid. This liquid will then be poured into conical containers that have the same base and height as the cylindrical container.
   a) How many cones will one cylinder fill?
   b) Determine the capacity, in L, of each cone. (*Note: 1 L = 1000 cm³*)

3.4 mm

17) The inverted right cone shown below, which has a base diameter of 3.4 mm and a slant height of 3.0 mm, is inscribed in a cylinder. Determine the volume of the cylinder.

3.0 mm
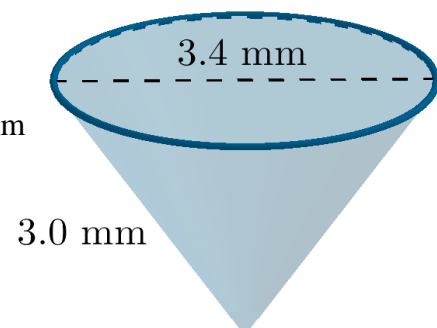
ANSWERS

1) A pyramid with the same base shape and height as a prism has one third the volume of the prism. Conversely, the volume of a prism is three times that of the corresponding pyramid.

2) 30 cm^3

3) 37.5 m^3

4) A cone with the same base circle and height as a cylinder has one third the volume of the cylinder. Conversely, the volume of a cylinder is three times that of the corresponding cone.

5) 173.4 cm^3, 57.8 cm^3

6) 66 cm^3 ,198 m^3

7) 8.92 cm^3

8) 93.3 cm^3

9) 168.75 mm^3

10) 2148.9 cm^3

11) 282.7 cm^3, 94.2 cm^3

12) a) 75.67 cm^3 b) Approximately \$2.33

13) a) We know that a cone with the same base circle and height as a cylinder has one third the volume of the cylinder. We can see that the expression for the volume of a cylinder $\left(\pi r^2 h\right)$ is either multiplied by $\dfrac{1}{3}$ or divided by 3 to obtain the volume of the corresponding cone.

b) $V_{\text{cylinder}} \approx 1583.4$ cm^3, $V_{\text{cone}} \approx 527.8$ cm^3 c) $V_{\text{cone}} \approx 127.4$ in^3, $V_{\text{cylinder}} \approx 382.3$ in^3

14) a) 1254.88 m^3 b) 418.3 m^3

15) 13.33 cm^3

16) a) 3   b) 2.65 L

17) 22.4 mm^3