1 Example of an appropriate method

Similarity ratio of the pyramids

$$k^3 = \frac{27}{8}$$
$$k = \frac{3}{2}$$

Height of the larger pyramid

$$\frac{\text{Height of the larger pyramid}}{\text{Height of the smaller pyramid}} = k$$
$$\frac{\text{Height of the larger pyramid}}{30 \text{ cm}} = \frac{3}{2}$$
$$\text{Height of the larger pyramid} = 45 \text{ cm}$$

Volume of the larger pyramid

Volume

$$\frac{3969 \text{ cm}^2 \times 45 \text{ cm}}{3} = 59\ 535 \text{ cm}^3$$

Volume of David's bucket

The volume of the larger pyramid is 27 times the volume of the bucket.

Volume of the bucket

$$\frac{59\ 535\ \text{cm}^3}{27} = 2205\ \text{cm}^3$$

Answer: David's bucket holds **2205** cm^3 of sand.

Note: Students who use an appropriate method in order to determine the height of the larger pyramid have shown that they have a partial understanding of the problem.

2 A

3 Example of an appropriate method

Volume of the block of modelling clay

$40 \times 15 \times 15 = 9000 \text{ cm}^3$

Volume of the smaller pyramid

$$\frac{10 \times 10 \times 30}{3} = 1000 \text{ cm}^3$$

Volume of the bigger pyramid

Volume of the block of modelling clay – Volume of the smaller pyramid

$9000 - 1000 = 8000 \text{ cm}^3$

Similarity ratio

$$k^3 = \frac{\text{Volume of the bigger pyramid}}{\text{Volume of the smaller pyramid}} = \frac{8000}{1000} = \frac{8}{1}$$

$$k = \sqrt[3]{\frac{8}{1}} = \frac{2}{1}$$

Height of the bigger pyramid

$$\frac{\text{Height of the bigger pyramid}}{\text{Height of the smaller pyramid}} = k$$

$$\frac{\text{Height of the bigger pyramid}}{30} = \frac{2}{1}$$

Height of the bigger pyramid: 60 cm

Answer The height of the bigger pyramid is **60** cm.

Note: Students who use an appropriate method in order to determine the ratio of the volumes of the two pyramids have shown that they have a partial understanding of the problem.

4 Example of an appropriate method

The cones are similar; therefore, the measures of the corresponding segments are proportional.

Height of the cone

Volume of the cone: 40 cm^3

$$\frac{\text{Height} \times \text{Area of the base}}{3} = 40$$

$$\frac{\text{Height} \times 4\pi}{3} = 40$$

Height of the cone: 9.549 cm

Height reached by the maple sugar in the cone this year

9.549 – 1 = 8.549 cm

Volume of maple sugar in the cone this year

$$k = \frac{\text{Height reached by the maple sugar in the cone this year}}{\text{Height of the cone}} = \frac{8.549}{9.549}$$

$$k^3 = \left(\frac{8.549}{9.549}\right)^3$$

$$\frac{\text{Volume of maple sugar in the cone this year}}{\text{Volume of the cone}} = k^3$$

$$\frac{\text{Volume of maple sugar in the cone this year}}{40} = \left(\frac{8.549}{9.549}\right)^3$$

Volume of maple sugar in the cone this year: 28.703 cm^3

Answer: This year, each cone contains **28.7** mL of maple sugar, to the nearest tenth.

Notes: Do not penalize students who did not round off their final answer or who made a mistake in rounding it off.

Students who use an appropriate method in order to determine the height reached by the maple sugar in the cone this year have shown that they have a partial understanding of the problem.

5 The volume of the larger prism is **2 880** cm^3.

6 Example of an appropriate method

Radius of the base of the larger cone

In a right triangle, the length of the side opposite a 30° angle is equal to half the length of the hypotenuse.

Therefore, the radius of the base of the larger cone is 18 cm.

Height of the larger cone

$\sqrt{36^2 - 18^2}$ (Pythagorean theorem)

Height of the smaller cone: 31.17691…

Height of the smaller cone

Since the cones are similar, the ratio of the heights is equal to the ratio of the radii of the bases.

$$\frac{\text{Height of the smaller cone}}{31.17691} = \frac{12}{18}$$

Height of the smaller cone = 20.7846…

Height of the sculpture

Height of the sculpture = height of the larger cone + height of the smaller cone

= 31.17691… + 20.7846…

= 51.9615…

Answer The total height of the sculpture to the nearest centimetre is 52 cm.

Note Do not penalize students who did not round off their final answer or who made a mistake in rounding it off.

Students who correctly or incorrectly determine the height of the larger cone have shown that they have a partial understanding of the problem.

7 Example of an appropriate solution

Since $\overline{DF} // \overline{BC}$, m ∠AFD = m ∠ACB

Since $\overline{EF} // \overline{AB}$, m ∠DAF = m ∠EFC

Since two angles of one triangle are congruent to the two corresponding angles of the other triangle, triangles DAF and EFC are similar and their corresponding segments are proportional in length.

Similarity ratio

Since $\overline{DF} // \overline{BC}$ and $\overline{EF} // \overline{AB}$, polygon BDFE is a parallelogram.

Hence, $m\ \overline{EF} = m\ \overline{BD} = 15\text{ cm}$.

$$k = \frac{m\ \overline{EF}}{m\ \overline{AD}} = \frac{15\text{ cm}}{5\text{ cm}} = \frac{3}{1}$$

Perimeter of ∆DAF

$$m\ \overline{AD} + m\ \overline{DF} + m\ \overline{FA}$$

5 + 10 + 7.5

22.5 cm

Perimeter of ∆EFC

$$\frac{\text{Perimeter of }\Delta EFC}{\text{Perimeter of }\Delta DAF}=\frac{3}{1}$$

$$\frac{\text{Perimeter of }\Delta EFC}{22.5\text{ cm}}=\frac{3}{1}$$

Perimeter of ΔEFC = 67.5 cm

Answer The perimeter of triangle EFC is 67.5 cm.

8

Example of an appropriate solution

Two similar figures have proportional corresponding sides.

Length of $\overline{PQ}$

$$\frac{m\overline{PQ}}{m\overline{DC}} = \frac{m\overline{AB}}{m\overline{PQ}}$$

$$\frac{m\overline{PQ}}{135} = \frac{60}{m\overline{PQ}}$$

$$(m\overline{PQ})^2 = 8100$$

$$m\overline{PQ} = 90\,\text{cm}$$

Length of $\overline{AP}$

$$\frac{m\overline{AP}}{m\overline{PD}} = \frac{m\overline{AB}}{m\overline{PQ}}$$

$$\frac{m\overline{AP}}{70 - m\overline{AP}} = \frac{60}{90}$$

$$90 \times m\overline{AP} = 4200 - 60 \times m\overline{AP}$$

$$150 \times m\overline{AP} = 4200$$

$$m\overline{AP} = 28\,\text{cm}$$

Answer The length of segment is 28 cm.

9 D

10 Work : (example)

Volume of the cylinder (soda pop)

Volume = area of the base × height

Volume = $3.14 \times 14^2 \times 60$

Volume = 36 926.4

Height of the cone

$$\sin \angle OAB = \frac{m\ \overline{OB}}{m\ \overline{AB}}$$

$$\sin 55^\circ = \frac{m\ \overline{OB}}{7}$$

$$m\ \overline{OB} = 0.82 \times 7 = 5.74$$

Radius of the cone

$$\cos \angle OAB = \frac{m\ \overline{OA}}{m\ \overline{AB}}$$

$$\cos 55^\circ = \frac{m\ \overline{OA}}{7}$$

$$m\ \overline{OA} = 0.57 \times 7 = 3.99$$

Volume of the cone

$$\text{Volume} = \frac{\text{Area of the base} \times \text{Height}}{3}$$

$$\text{Volume} = \frac{3.14 \times (3.99)^2 \times 5.74}{3}$$

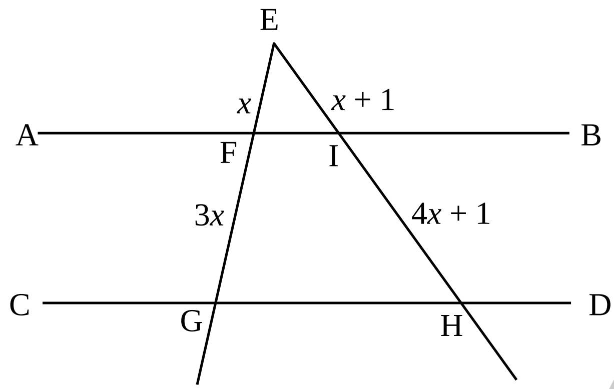
Volume = 95.65

Number of cups

36 926.4 ÷ 95.65 ≈ 386.06

Result 386 cups can be filled.

11 Work : (example)



Statements	Justifications
1. $\Delta EFI \sim \Delta EGH$	The two triangles have two corresponding angles congruent : $\angle E$ is common; $\angle EFI \cong \angle EGH$ because when two parallel line are cut by a transversal, the corresponding angles are congruent.
2. m $\overline{EF}$ = 2 units	
$\frac{m\ \overline{EF}}{m\ \overline{EG}} = \frac{m\ \overline{EI}}{m\ \overline{EH}}$	In similar triangles the corresponding sides are proportional.
$\frac{x}{4x} = \frac{x+1}{5x+2}$	By substitution

$5x^2 + 2x = 4x^2 + 4x$

$x^2 - 2x = 0$

$x(x - 2) = 0$

$x_1 = 0$ (to be rejected)

$x_2 = 2$ units = m $\overline{EF}$

12 Work : (example)

Height of the small cone

$$\text{Volume} = \frac{\text{Area of the base} \times \text{Height}}{3}$$

$$157 = \frac{\pi \times 5^2 \times \text{Height}}{3}$$

Height = 6

Height of the large cone

Height of the small cone × 2 (The similarity ratio is 2.)

6 × 2 = 12

Radius of the base of the large cone

Radius of the base of the small cone × 2 (The similarity ratio is 2.)

5 × 2 = 10

Measure of angle A

$$\tan A = \frac{\text{measure of opposite side}}{\text{measure of adjacent side}}$$

$$\tan A = \frac{12}{10} = 1.2$$

$m\angle A \approx 50.2°$

Result Rounded to the nearest degree, the measure of angle A is 50°.

13 Work : (example)

Calculate the lateral surface area of the smaller cylinder

$A = 2 \times \pi \times r \times h$

$A = 2 \times \pi \times 4 \times 10$

$A = 80\pi$

Ratio of their areas is

ratio of their sides = $\sqrt[3]{\frac{125}{216}} = \frac{5}{6}$

ratio of their areas = $\left(\frac{5}{6}\right)^2 = \frac{25}{36}$

Calculate the lateral surface area of the larger cylinder

$\frac{25}{36} = \frac{80\pi}{x}$

$x \approx 361.91$

Result : The lateral surface area of the larger cylinder is 362 cm^2.

14 Work : (example)

Radius of the base of the big cone

Radius of the base of the small cone $\times$ 2 (The scale factor of the lengths of their corresponding elements is 2.)

$3 \times 2 = 6$ cm

Height of the big cone

$$\tan 58^\circ = \frac{\text{measure of opposite side}}{\text{measure of adjacent side}}$$

$$\tan 58^\circ = \frac{\text{height}}{6}$$

Height = $6 \tan 58^\circ \approx 9.6$ cm

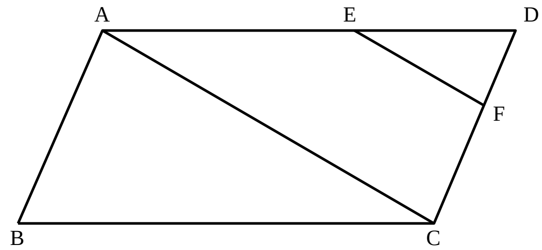
Volume of the big cone

$$\text{Volume} = \frac{\text{area of the base} \times \text{height}}{3} = \frac{\pi \times 6^2 \times 9.6}{3} \approx 361.9$$

Result Rounded to the nearest unit, the volume of the big cone is 362 cm^3.

15 C

16 Work : (example)



Statements	Justifications
1. $\Delta ABC \sim \Delta FDE$	Two pairs of corresponding angles are congruent :
	$\angle ACB \cong \angle FED$ given in the hypothesis,
	$\angle B \cong \angle D$ because the opposite angles of a parallelogram are congruent.
2. m $\overline{DF}$ = 8.8 cm	
$\frac{m\ \overline{DF}}{m\ \overline{BA}} = \frac{m\ \overline{EF}}{m\ \overline{CA}}$	In similar triangles, the corresponding sides are proportional.
$\frac{m\ \overline{DF}}{22} = \frac{18}{45}$	By substitution
hence, m $\overline{DF}$ = 8.8 cm	

17 A

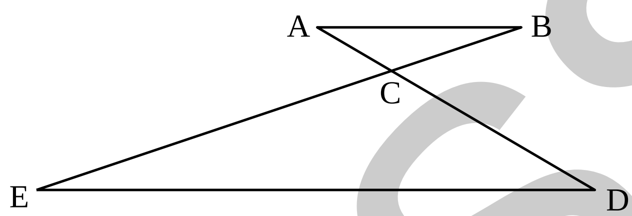
18 Work : (example)

m $\overline{DA}$ = 8 cm

m $\overline{EB}$ = 12 cm

m $\overline{EC}$ = $\dfrac{3(m\ \overline{EB})}{4}$

m $\overline{DC}$ = $\dfrac{3(m\ \overline{DA})}{4}$



Statements		Justifications
1.	m $\overline{DC}$ = 6 cm	$\frac{3}{4} \times$ 8 cm = 6 cm
	m $\overline{AC}$ = 2 cm	8 cm – 6 cm = 2 cm
2.	m $\overline{EC}$ = 9 cm	$\frac{3}{4} \times$ 12 cm = 9 cm
	m $\overline{BC}$ = 3 cm	12 cm – 9 cm = 3 cm
3.	$\dfrac{m\ \overline{AC}}{m\ \overline{DC}} = \dfrac{m\ \overline{BC}}{m\ \overline{EC}}$	$\dfrac{2}{6} = \dfrac{3}{9}$

4.	$\angle ACB \cong \angle DCE$	Vertical angles are congruent.
5.	$\Delta ABC \sim \Delta DEC$	Two triangles are similar if the angles included between corresponding proportional sides are congruent (S.A.S. Similarity Theorem).

Note : Steps 1 and 2 are optional.

19 Work : (example)

Calculation of the small diagonal

$$\sqrt{21^2 + 28^2} = 35$$

Calculation of the sides of the large rectangle

Given *x* : width of the large rectangle

y : length of the large rectangle

Proportions representing this situation

$$\frac{x}{21} = \frac{45}{35} \text{ and } \frac{y}{28} = \frac{45}{35}$$

Therefore $x = 27$ and $y = 36$

Calculation of the area of the large rectangle

A = 27 × 36 = 972

Result The area of the enlarged photograph is 972 cm^2.

20 C

21 Work : (example)

Similarity ratio of the hexagons (All regular hexagons are similar.)

$\sqrt{\frac{9}{16}} = \frac{3}{4}$ (The similarity ratio of two figures is equal to the square root of the ratio of their areas.)

Perimeter of the small hexagon

$6 \times 6 = 36$

Perimeter P of the large hexagon

$\frac{36}{P} = \frac{3}{4}$ (The ratio of the perimeters is equal to the similarity ratio.)

P = 48

Result The perimeter of the large hexagon is 48 m.

22 D

23 C

24 Work : (example)

Measure of segment BC

$$\left(m\ \overline{BC}\right)^2 = \left(m\ \overline{AB}\right)^2 + \left(m\ \overline{AC}\right)^2$$

$$\left(m\ \overline{BC}\right)^2 = (18)^2 + (24)^2$$

$$\left(m\ \overline{BC}\right)^2 = 900$$

$$m\ \overline{BC} = 30$$

Measure of segment MC

$$m\ \overline{MC} = \frac{m\ \overline{BC}}{2}$$

$$m\ \overline{MC} = \frac{30}{2}$$

$$m\ \overline{MC} = 15$$

Measure of segment MD

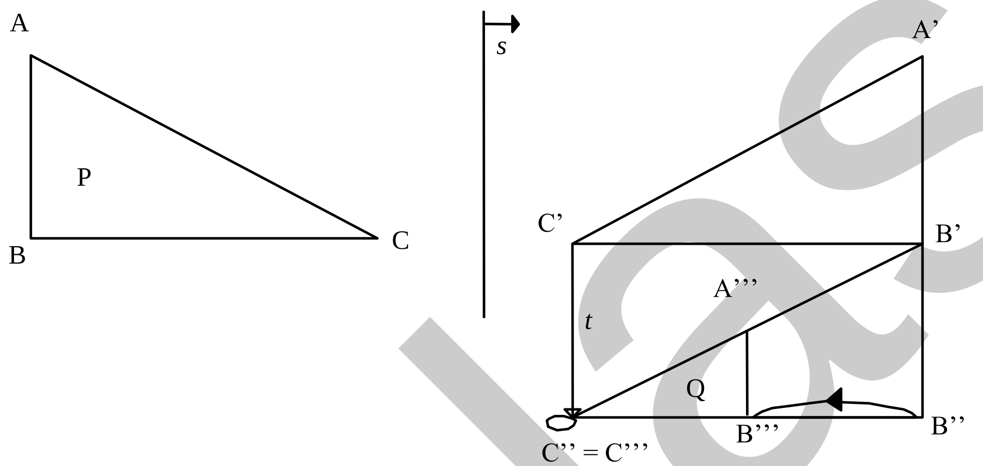
$$\frac{m\ \overline{MD}}{m\ \overline{AB}} = \frac{m\ \overline{MC}}{m\ \overline{AC}}$$

$$\frac{m\ \overline{MD}}{18} = \frac{15}{24}$$

$$m\ \overline{MD} = 11.25$$

Answer the measure of segment MD is 11.25 cm.

25 Accurate construction and correct identification of the transformations.



Result : a reflection followed by a translation followed by a dilatation or *h* o *t* o *s*

26

Work : (example)

The student finds the value of segment BE

$$\left(m\ \overline{BE}\right)^2 = \left(m\ \overline{AB}\right)^2 - \left(m\ \overline{AE}\right)^2$$

$$\left(m\ \overline{BE}\right)^2 = 50^2 - 40^2$$

$$\left(m\ \overline{BE}\right)^2 = 900$$

$$m\ \overline{BE} = 30$$

The student establishes the proportion.

$$\frac{m\ \overline{AB}}{m\ \overline{AB} + m\ \overline{BC}} = \frac{m\ \overline{BE}}{m\ \overline{DC}}$$

The solution of the equation

$$\frac{50}{50 + m\ \overline{BC}} = \frac{30}{150}$$

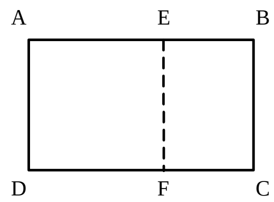
$$m\ \overline{BC} = 200$$

Result The length of the pond is 200 metres.

Any other complete and acceptable work with the correct result.

27 Work : (example)

Calculate the length of $\overline{AB}$



$$\frac{m\,\overline{AB}}{m\,\overline{EF}} = \frac{m\,\overline{BC}}{m\,\overline{EB}}$$

(1) The corresponding sides of two similar rectangles are proportional.

$m\,\overline{AE} = 2\,m$

$m\,\overline{AB} = m\,\overline{AE} + m\,\overline{EB}$

$m\,\overline{AB} = 2 + m\,\overline{EB}$ (2)

Calculate the length of $\overline{EB}$

Replace the value of m $\overline{AB}$ in (1)

$$\frac{2 + m\,\overline{EB}}{2} = \frac{2}{m\,\overline{EB}}$$

$$m\,\overline{EB}\left(2 + m\,\overline{EB}\right) = 4$$

$$2m\,\overline{EB} + \left(m\,\overline{BE}\right)^2 = 4$$

$$\left(m\,\overline{EB}\right)^2 + 2m\,\overline{EB} - 4 = 0$$

$$m\ \overline{EB} = \frac{-2 + \sqrt{4 - 4(1)(-4)}}{2}$$

$$m\ \overline{EB} = -1 + \sqrt{5}$$ The measurement is positive.

$$m\ \overline{EB} = 1.236\ 068$$

Length of side AB

$$m\ \overline{AB} = m\ \overline{EB} + m\ \overline{AE}$$

$$= 1.236\ 068 + 2$$

$$m\ \overline{AB} = 3.236\ 068$$

Result : Side AB must be 3.236 068 m.

NOTE : Accept a result rounded to 3.24 or a result that belongs to [3.23, 3.24].

Name : ___________________________________

Group : ___________________________________

Date : ___________________________________

568436 - Mathematics

Question Booklet

1 Using the sand at the beach, David made two right pyramids with square bases. To do this, he filled a bucket with sand several times.

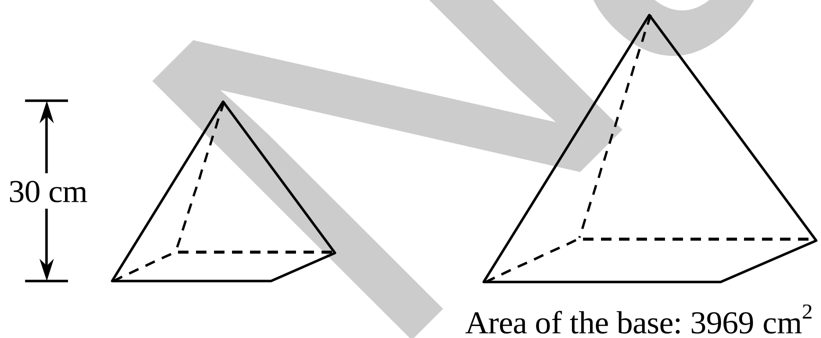
To build the smaller pyramid, David filled his bucket 8 times.

To build the larger pyramid, David filled his bucket 27 times.

The resulting pyramids are similar.

The height of the smaller pyramid is 30 cm.

The area of the base of the larger pyramid is 3969 cm^2.



How many cm^3 of sand does David's bucket hold?

Show all your work.

2 Which of the following statements is always true?

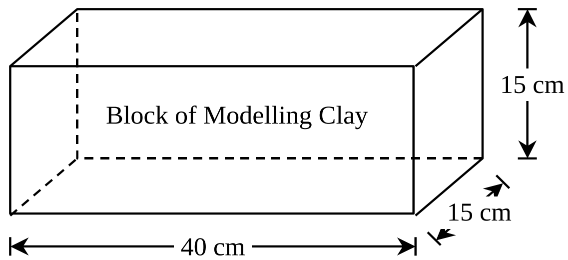
A) If two spheres are equivalent, then they are congruent.

B) If two right circular cylinders are equivalent, then they are congruent.

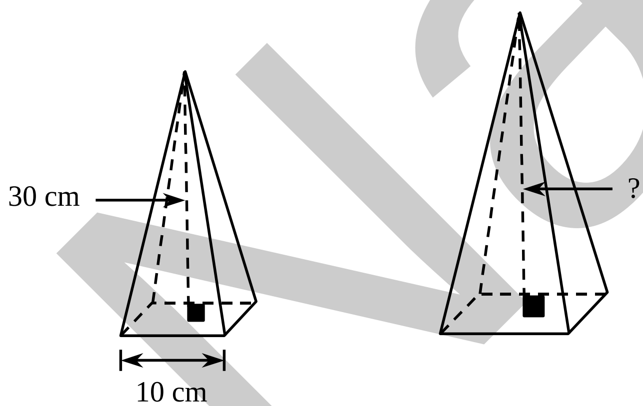
C) If two right pyramids with square bases are equivalent, then they are congruent.

D) If two right rectangular prisms are equivalent, then they are congruent.

3 A block of modelling clay in the shape of a right prism measures 40 cm by 15 cm by 15 cm.



An artisan uses all this modelling clay to make two similar right pyramids. They each have a square base. Each edge of the base of the smaller pyramid measures 10 cm. The height of the smaller pyramid is 30 cm.



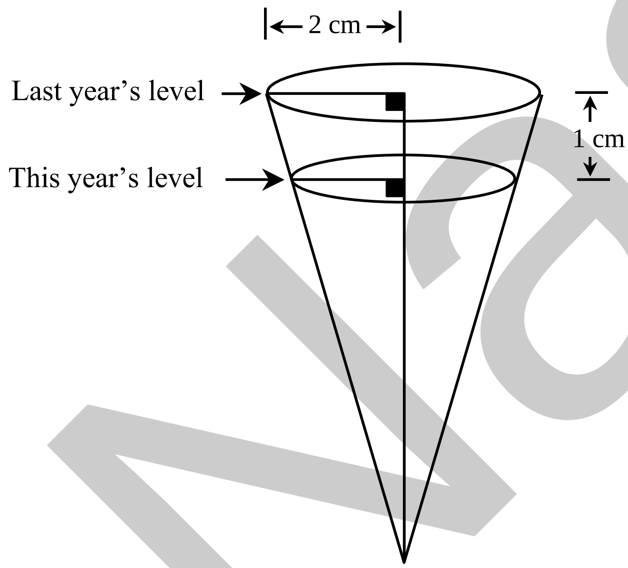
What is the height of the bigger pyramid?

Show all your work.

4 A sugar shack sells maple sugar cones. Each cone is in the shape of a right circular cone. The radius of the base of the cone is 2 cm.

Last year, 40 mL of maple sugar was required to fill a cone to the top.

This year, management decided not to fill the cones to the same level in order to save money. The maple sugar in the cones reaches a height that is 1 cm less than it was last year.

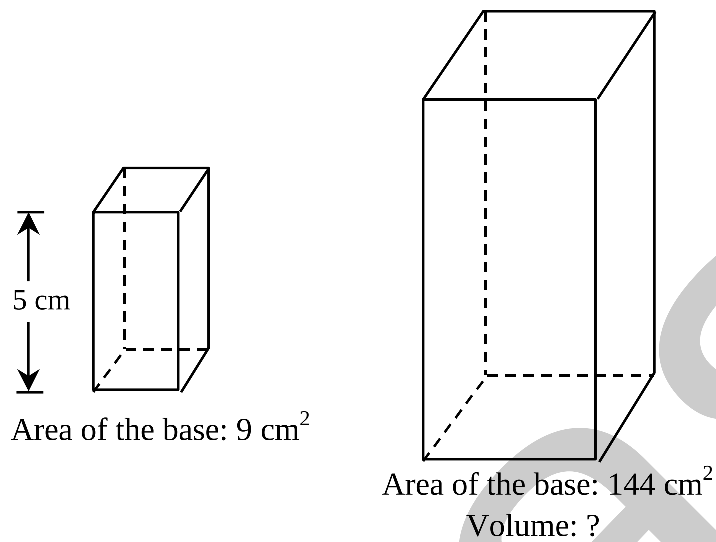


Note: 1 mL = 1 cm^3

To the nearest tenth of a millilitre, how much maple sugar does each cone contain this year?

Show all your work.

5 The two right prisms shown below are similar. They both have square bases. The area of the base of the larger prism is 144 cm^2. The area of the base of the smaller prism is 9 cm^2. The height of the smaller prism is 5 cm.



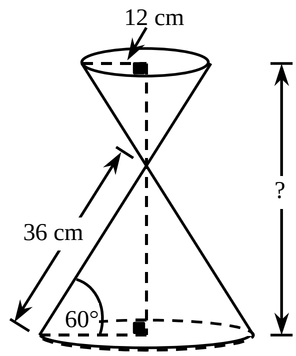
What is the volume of the larger prism?

6

A sculpture is composed of two similar right circular cones.

The slant height of the larger cone is 36 cm.

The radius of the base of the smaller cone is 12 cm.



What is the total height of the sculpture to the nearest centimetre?

Show all your work.

7 In triangle ABC shown on the right,

$\overline{DF} \parallel \overline{BC}$

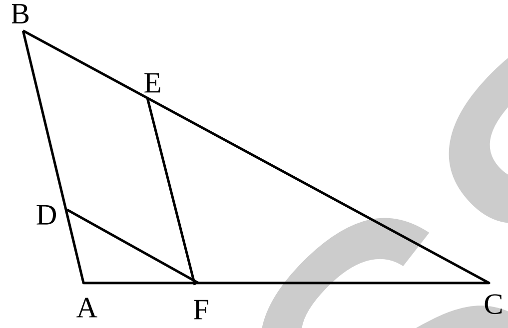
$\overline{EF} \parallel \overline{AB}$

$m\ \overline{AD} = 5$ cm

$m\ \overline{DB} = 15$ cm

$m\ \overline{DF} = 10$ cm

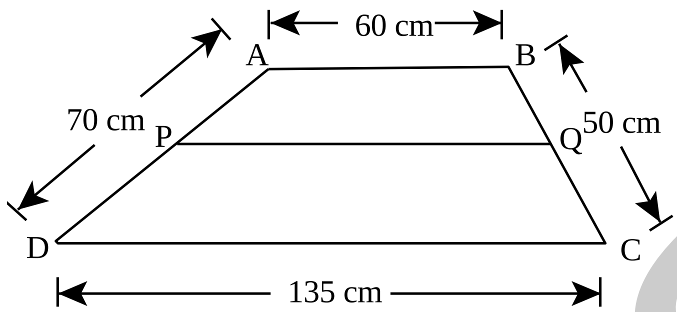
$m\ \overline{AF} = 7.5$ cm



What is the perimeter of triangle EFC?

Show all your work.

8 In trapezoid ABCD illustrated below, segment PQ is drawn parallel to the bases, making trapezoid ABQP similar to trapezoid PQCD.

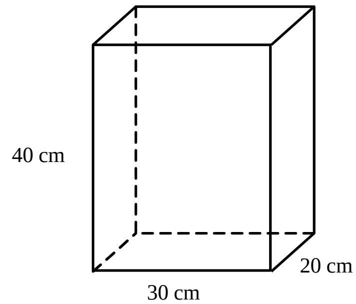


What is the length of segment AP in cm?

Show all your work.

9

The dimensions of a prism are given in the adjacent diagram.



To the nearest tenth of a centimetre, what is the height of a similar prism whose volume is 10 times as small than the one shown above?

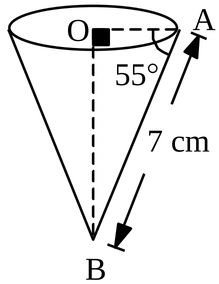
A) 4.0 cm

B) 9.3 cm

C) 13.9 cm

D) 18.6 cm

10 A container shaped like a right circular cylinder is filled with soda pop. The height of this cylindrical container is 60 cm and its radius is 14 cm. The liquid in this container will be used to **fill** the largest possible number of cups shaped like a right circular cone.



m $\angle OAB = 55°$

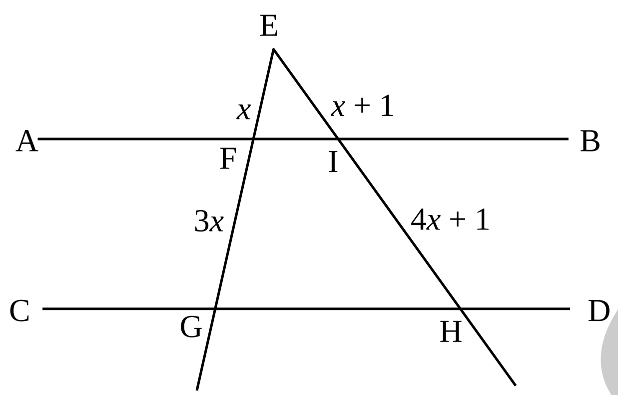
m $\overline{AB}$ = 7 cm

How many cups can be filled with the liquid in the cylindrical container?

All your calculations must be rounded off to the nearest hundredth ($\pi = 3.14$).

Show your work.

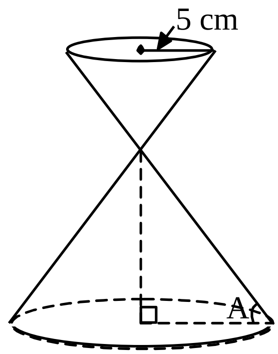
11 In the figure below, lines AB and CD are parallel. All the segments are measured in units.



Show that the measure of segment EF is 2 units.

Justify each step of your proof.

12 In the figure below, the two cones are similar with a similarity ratio of 2. The volume of the small cone is 157 cm^3 and the radius of its base is 5 cm.



Rounded to the nearest degree, what is the measure of angle A?

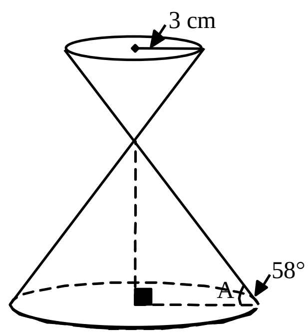
Show your work.

13 The ratio of the volumes of two similar cylinders is $\frac{125}{216}$. The radius of the smaller cylinder is 4 cm, and its height is 10 cm.

To the nearest cm^2, what is the lateral surface area of the larger cylinder?

Show your work.

14 In the figure below, the two cones are similar. The scale factor of the lengths of their corresponding elements is 2. The radius of the base of the small cone is 3 cm. Angle A measures 58°.



Rounded to the nearest unit, what is the volume of the big cone?

Show your work.

15 A large piece of metal with a volume of 3768 cm^3 is completely melted to produce small pieces. The large piece is in the shape of a cylinder and all the small pieces being produced are similar to it. The area of the base of the large piece is 314 cm^2 and that of each small piece is 78.5 cm^2.

How many small pieces can be produced from the large one?

A) 2

B) 4

C) 8

D) 64

16 In the parallelogram ABCD on the right,

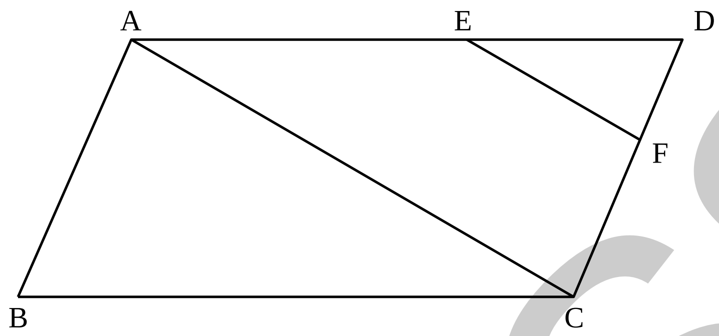
$\angle ACB \cong \angle FED$

$m\ \overline{AB} = 22$ cm

$m\ \overline{BC} = 47$ cm

$m\ \overline{AC} = 45$ cm

$m\ \overline{EF} = 18$ cm

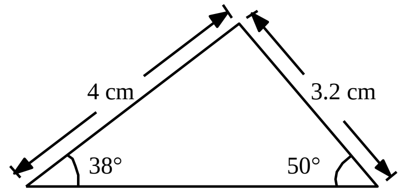


Show that segment DF measures 8.8 cm.

Justify each step of your proof.

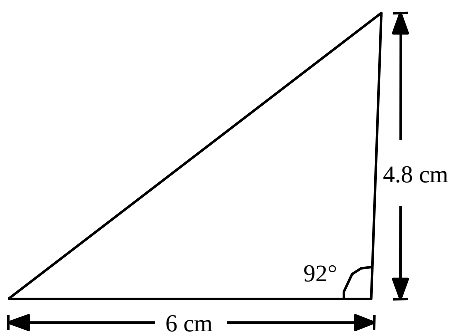
17

One of the triangles below is similar to the one shown at the right.

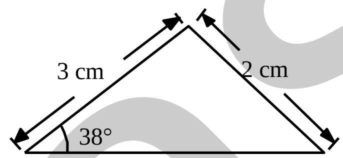


Which triangle is it?

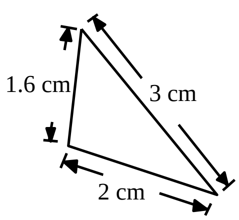
A)



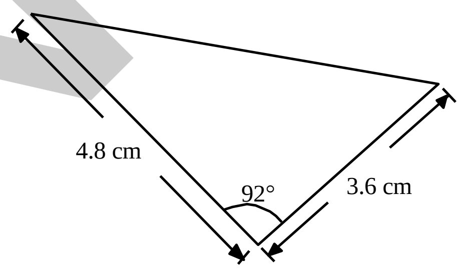
C)



B)



D)



18

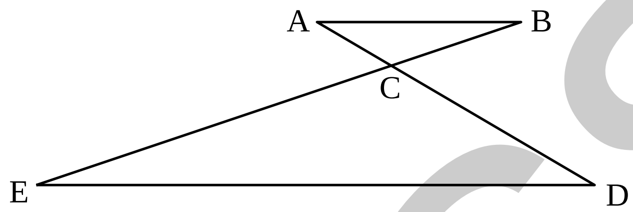
In the figure on the right,

$m\ \overline{DA} = 8$ cm

$m\ \overline{EB} = 12$ cm

$m\ \overline{EC} = \dfrac{3(m\ \overline{EB})}{4}$

$m\ \overline{DC} = \dfrac{3(m\ \overline{DA})}{4}$



Show that triangle ABC is similar to triangle DEC.

Justify each step followed.

19

A photographer wants to enlarge a rectangular photograph that is 21 cm by 28 cm. The enlarged photograph is to be similar to the original and must have a diagonal of 45 cm.

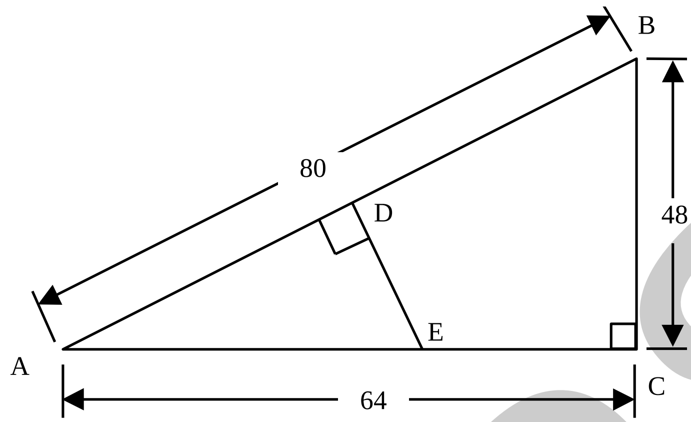
What is the area of the enlarged photograph?

Show your work.

20

In the diagram below, triangle ABC has a right angle at C and measurements as indicated.

D is the midpoint of $\overline{AB}$.



What is the measure of segment EC?

A) 32.0 units

B) 24.0 units

C) 14.0 units

D) 10.7 units

21 The ratio of the areas of two regular hexagons (6 sides) is $\frac{9}{16}$.

One side of the small hexagon measures 6 m.

What is the perimeter of the large hexagon?

Justify the steps of your reasoning.

22 A slide measuring 20 mm by 35 mm is projected onto a screen. The image thus projected measures 4 m by 7 m. There is a flag on the slide whose area is 1 cm^2.

What is the area of the image of the flag on the screen?

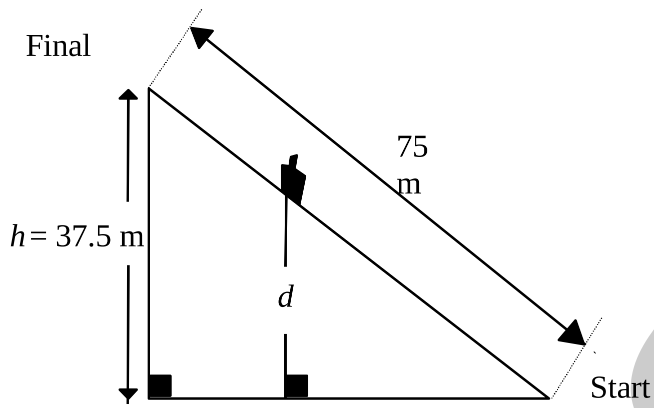
A) 2000 cm^2

B) 4000 cm^2

C) 20 000 cm^2

D) 40 000 cm^2

23 A chair lift travels a distance of 75 m from bottom to top and drops off the riders at a height of 37.5 m above the starting point as shown below.



If the chair lift breaks down $\frac{2}{3}$ of the way up, at what height *d* are they above the ground?

A) 12.5 m

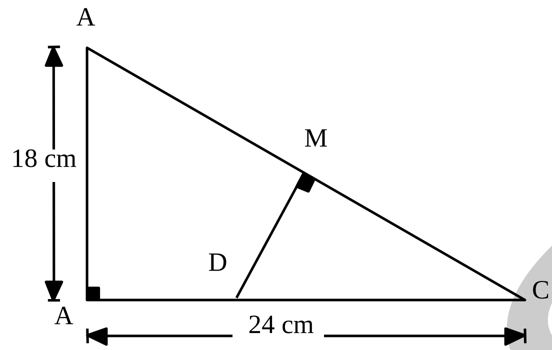
B) 21 m

C) 25 m

D) 29 m

24

In the diagram at the right, triangle ABC is right-angled at A.



$m\ \overline{AB} = 18\text{ cm}$

$m\ \overline{AC} = 24\text{ cm}$

$\overline{DE} \perp \overline{BC}$

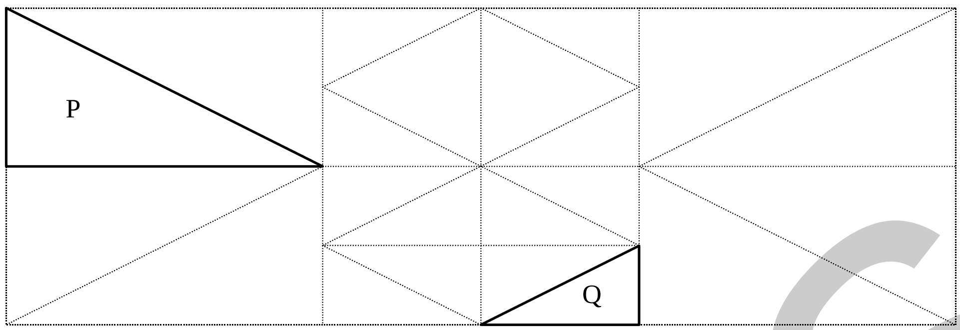
M is the midpoint of $\overline{BC}$

$\Delta ABC \cong \Delta MDC$

In centimetres, what is the measure of segment MD?

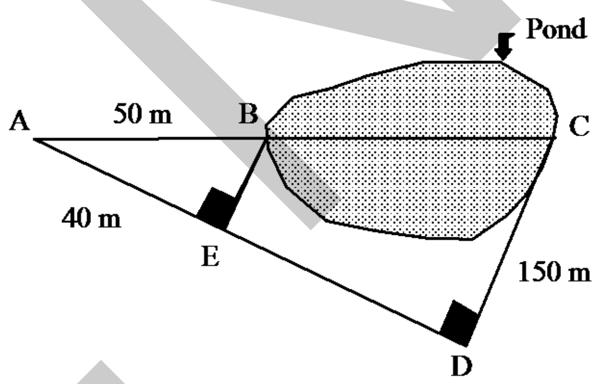
Show all your work.

25 At a home decoration show, a manufacturer of floor covering shows various models of tiling. The following is an example:



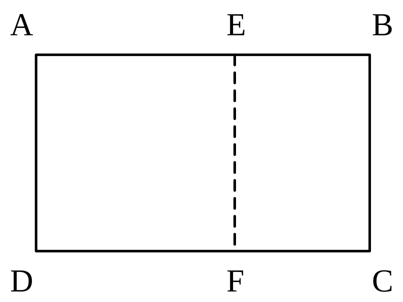
Draw and identify a composite of geometric transformations which can be used to apply figure P onto figure Q.

26 Find the length BC of the pond using the technique shown in the following diagram.



Show all your work.

27 Height EF, measuring 2 m, is drawn in the exterior of rectangle ABCD such that quadrilateral AEFD is a square. Rectangle BCFE is similar to rectangle ABCD. The ancient Greeks called this figure the "golden rectangle".



How long must side AB be for rectangle ABCD to qualify as a "golden rectangle"?

Show all your work.