

Two figures are similar if they have the same shape, same angles but different size. The symbol for similarity is  $\cong$

If  $\triangle ABC \cong \triangle PQR$ , then  $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = k$  (where  $k$  is some constant)

and the corresponding angles are equal.  $\angle A = \angle P$ ,  $\angle B = \angle Q$  and  $\angle C = \angle R$

Area of similar figures: Volume of similar solid figures: Mass of similar solids:

$$\frac{A_1}{A_2} = \left( \frac{\text{side 1}}{\text{side 2}} \right)^2$$

$$\frac{V_1}{V_2} = \left( \frac{\text{side 1}}{\text{side 2}} \right)^3$$

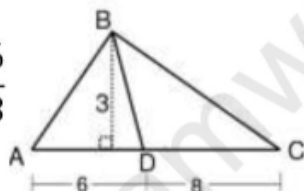
$$\frac{m_1}{m_2} = \left( \frac{\text{side 1}}{\text{side 2}} \right)^3$$

Relationship between Area and Volume of similar figures:

$$\sqrt[2]{\frac{A_1}{A_2}} = \sqrt[3]{\frac{V_1}{V_2}}$$

If two triangles have equal height then the ratio of their areas is the ratio of their bases

$$\frac{\text{Area } \triangle ABD}{\text{Area } \triangle DBC} = \frac{6}{8}$$



1. Some cones are mathematically similar.

Two of the cones have radii in the ratio 2:3.

Write down the ratio of their masses. [1]

0580/42/M/J/15 Q4(c)(ii)



2. A company makes solid chocolate eggs and their shapes are mathematically similar.

The eggs have height 2 cm and 6 cm.

The mass of the small egg is 4 g.

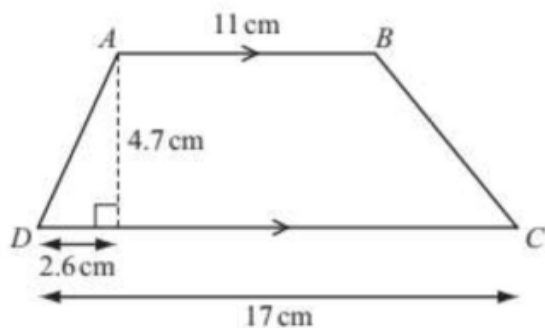
Calculate the mass of the large egg. [2]

0580/21/M/J/11 Q6)



3. Two mathematically similar triangles, T and U have two corresponding sides of lengths 3 cm and 12 cm.  
The area of triangle T is  $5\text{cm}^2$ .  
Find the area of triangle U. [2]  
**0580/22/M/J/18 Q11)**

4. ABCD is a trapezium.



- (a) Calculate the area of the trapezium ABCD. [2]  
(b) A **similar** trapezium has perpendicular height 9.4cm.  
Calculate the area of this trapezium. [3]

**0580/43/O/N/14 Q1**

5. A and B are two similar pentagons.



The area of A is  $126\text{ cm}^2$  and the area of B is  $56\text{ cm}^2$ .  
Calculate the value of  $x$ . [3]

**0580/27/M/J/14 Q16)**



6. Cylinder A is mathematically similar to cylinder B.

The height of cylinder A is 10 cm and  
its surface area is  $440\text{cm}^2$ .

The surface area of cylinder B is  $3960\text{cm}^2$ .

Calculate the height of cylinder B. [3]

**0580/21/O/N/17 Q20 (b)**

7. Two mathematically similar shapes have areas

$262\text{cm}^2$  and  $65.5\text{cm}^2$ .

The width of the larger shape is 17 cm.

Calculate the width of the smaller shape. [3]

**0580/42/M/J/19 Q10(c)**

8. Marianne sells two sizes of photo.

These photos are mathematically similar rectangles.

The smaller photo has length 15cm and width 12cm.

The larger photo has area  $352.8\text{cm}^2$ .

Calculate the length of the larger photo.

**0580/41/O/N/18 Q1(b)**

9. A quadrilateral P is enlarged by a scale factor of 1.2  
to give quadrilateral Q.

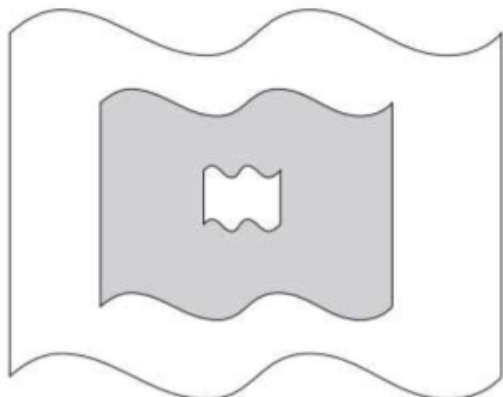
The area of quadrilateral P is  $20\text{cm}^2$ .

Calculate the area of quadrilateral Q. [2]

**0580/43/M/J/22 Q2(b)**



10. The diagram shows three shapes that are mathematically similar.



The heights of the shapes are in the ratio  
small : medium : large = 1 : 5 : 8.

Find the ratio shaded area : total unshaded area.

Give your answer in its simplest form. [4]

**0580/21/O/N/21 Q15)**

11. Two mathematically similar containers have heights  
of 30cm and 75cm.

The larger container has a capacity of 5.5 litres.

Calculate the capacity of the smaller container.

Give your answer in millilitres.[3]

**0580/22/O/N/19 Q13)**

12. The volumes of two similar cones are  $36\pi\text{cm}^3$  and  $288\pi\text{cm}^3$ .

The base radius of the smaller cone is 3cm.

Calculate the base radius of the larger cone [3]

**0580/23/M/J/13 Q6)**

13. Two mathematically similar vases are such that,

Vase A has height 20 cm and volume  $1500\text{cm}^3$ .

Vase B has volume  $2592\text{cm}^3$ .

Calculate h, the height of vase B. [3]

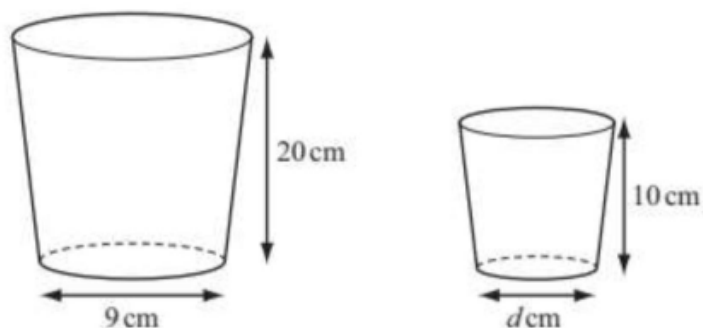
**0580/23/M/J/16 Q21 (b)**



14. The diagrams show two mathematically similar containers.

The larger container has a base with diameter 9 cm and a height 20 cm.

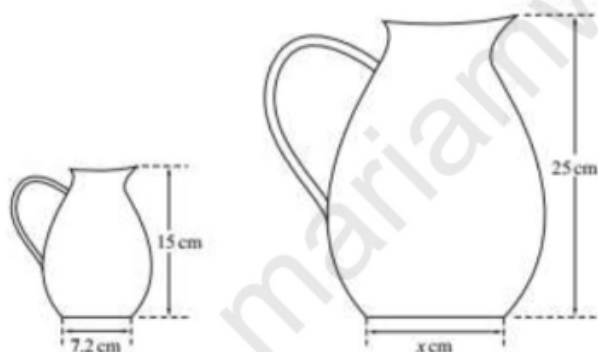
The smaller container has a base with diameter  $d$  cm and a height 10 cm.



- (a) Find the value of  $d$ .  
(b) The larger container has a capacity of 1600 ml.  
Calculate the capacity of the smaller container. [2]

0580/23/M/J/11 Q17)

15. (a) The diagram shows two jugs that are mathematically similar.



Find the value of  $x$ . [2]

- (b) Two glasses that are mathematically similar.

The height of the larger glass is 16 cm and its volume is  $375 \text{ cm}^3$ .

The height of the smaller glass is  $y$  cm and its volume is  $192 \text{ cm}^3$ .

Find the value of  $y$ . [3]

0580/22/O/N/15 Q21)



16. A cone, with radius  $x$  and height  $y$ , has a volume  $W$ .

Find, in terms of  $W$ , the volume of

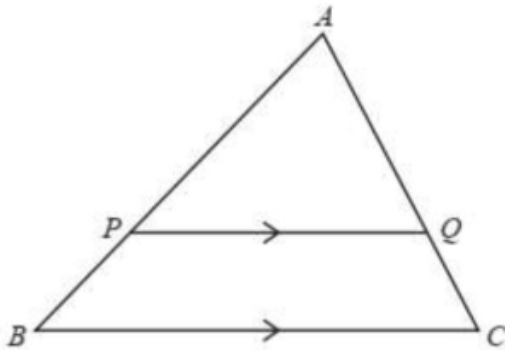
(i) a similar cone, with both radius and height 3 times larger, [1]

(ii) a cone of radius  $2x$  and height  $y$  [1]

[The volume,  $V$ , of a cone of radius  $r$  and height  $h$  is  $V = \frac{1}{3}\pi r^2 h$ .]

0580/04/O/N/09 Q7)(c)

17. (a) In the diagram,  $PQ$  is parallel to  $BC$ .



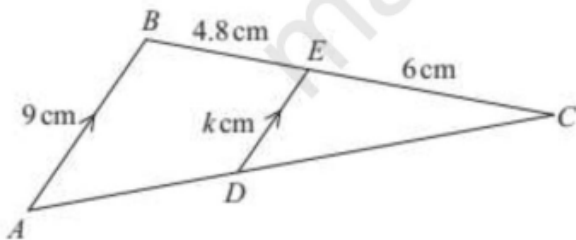
$APB$  and  $AQC$  are straight lines.

$PQ = 8$  cm,  $BC = 10$  cm and  $AB = 9$  cm.

Calculate  $PB$ . [2]

0580/23/M/J/18 Q25)(a)

18. Triangles  $CBA$  and  $CED$  are similar.



$AB$  is parallel to  $DE$ .

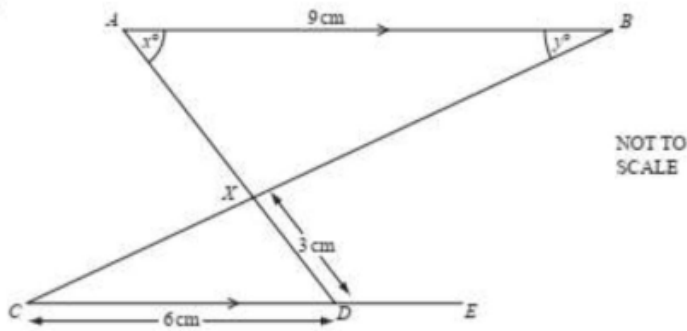
$AB = 9$  cm,  $BE = 4.8$  cm,  $EC = 6$  cm and  $ED = k$  cm.

Work out the value of  $k$ . [2]

0580/23/M/J/16 Q21



19. The lines AB and CDE are parallel.



AD and CB intersect at X.

AB = 9 cm, CD = 6 cm and DX = 3 cm.

(i) Complete the following statement.

Triangle ABX is \_\_\_\_\_ to triangle DCX. [1]

(ii) Calculate the length of AX. [2]

(iii) The area of triangle DCX is  $6 \text{ cm}^2$ .

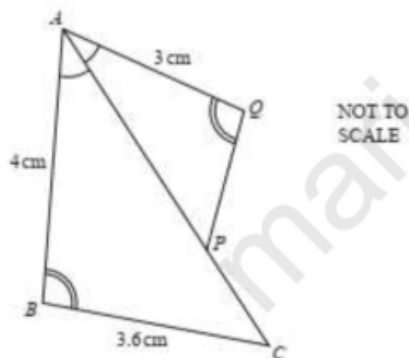
Calculate the area of triangle ABX. [2]

(iv) Angle BAX =  $x^\circ$  and angle ABX =  $y^\circ$ .

Find angle AXB and angle XDE in terms of  $x$  and/or  $y$ . [2]

**0580/42/M/J/10 Q9(a)**

20. The diagram shows two triangles ACB and APQ.



Angle PAQ = angle BAC and angle AQP = angle ABC.

AB = 4 cm, BC = 3.6 cm and AQ = 3 cm.

(i) Complete the following statement.

Triangle ACB is .....to triangle APQ. [1]

(ii) Calculate the length of PQ. [2]

(iii) The area of triangle ACB is  $5.6 \text{ cm}^2$ .

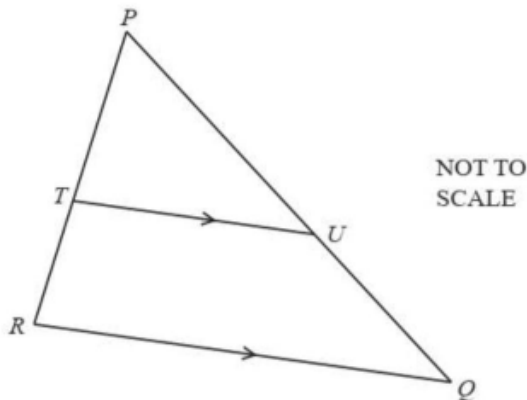
Calculate the area of triangle APQ. [2]

**0580/43/M/J/10 Q5(a)**





21. PQR is a triangle.



T is a point on PR and U is a point on PQ.

RQ is parallel to TU.

(i) Explain why triangle PQR is similar to triangle PUT.

Give a reason for each statement you make.

.....  
.....  
.....  
..... [3]

(ii)  $PT : TR = 4 : 3$

(a) Find the ratio  $PU : PQ$ . [1]

(b) The area of triangle PUT is  $20\text{cm}^2$ .

Find the area of the quadrilateral QRTU. [3]

**0580/43/O/N/20 Q5**

22. Two cones are mathematically similar.

The total surface area of the smaller cone is  $80\text{cm}^2$ .

The total surface area of the larger cone is  $180\text{cm}^2$ .

The volume of the smaller cone is  $168\text{cm}^3$ .

Calculate the volume of the larger cone. [3]

**0580/41/O/N/19 Q4(c)**

23. Two mathematically similar solid metal prisms are such that.

The volume of the smaller prism is  $648\text{cm}^3$  and the volume of the larger prism is  $2187\text{cm}^3$ .

The area of the cross-section of the smaller prism is  $36\text{cm}^2$ .

Calculate the area of the cross-section of the larger prism. [3]

**0580/43/O/N/19 Q6(b)(i)**





24. The two containers are mathematically similar in shape.

The larger container has a volume of  $3456\text{cm}^3$  and a surface area of  $1024\text{cm}^2$ .

The smaller container has a volume of  $1458\text{cm}^3$ .

Calculate the surface area of the smaller container. [4]

0580/22/M/J/14 Q18)

**Answer**

1) 8 : 27	13) 24
2) 108	14) (a)4.5 (b)200
3) 80	15) (a)12 (b)12.8
4) (a) 65.8 (b) 263.2	16) (i) 27 W(ii)4W
5) 8	17) 1.8
6) 30	18) (a)5 (b)24
7) 8.5	19) (a) (i) Similar (ii) 4.5 (iii) 13.5 (iv) $180 - x - y$ oe $180 - x$ oe
8) 21	20) (i) Similar (ii) 2.7 (iii) 3.15
9) 28.8	21) (i) Angle PTU = angle PRQ corresponding , Angle PUT = angle PQR corresponding , Angle RPQ is common oe hence Corresponding angles are equal oe (ii)(a)4:7 (b) 41.25
10) 3 : 5	22) 567
11) 352	23) 81
12) 6	24) 576