7 1.5 cm

8 a 13291.25 cm^3 b 75

9 Suitable proof, e.g. AEB is isosceles (AE = BE) therefore ∠EAB = ∠EBA.
By alternate angles, ∠EAB = ∠ECD and ∠EBA = ∠EDC so triangle CDE is isosceles.
So AC = BD (corresponding lengths are the same)
By alternate angles, ∠AGF = ∠FDC and ∠BHJ = ∠JCD, so ∠FDE = ∠JCE.
Therefore, by AAS, we know that triangles ACH and BDG are congruent.

10 30.8 cm

11 a 18 cm b 1350π cm^3 c 400π cm^3 d $950\pi = 2980$ cm^3 to 3 s.f.

12 3500 cm^3

13 AD = AB and AE = AG; ∠EAB = ∠DAG = 90° + ∠DAE. Therefore the triangles are congruent (SAS).

14 Linear scale factor $= \frac{(x^2-1)}{2(x-1)} = \frac{(x+1)(x-1)}{2(x-1)} = \frac{x+1}{2}$

Area scale factor $= \left(\frac{x+1}{2}\right)^2$

Area of B $= 8 \times \left(\frac{x+1}{2}\right)^2 = \frac{8(x^2+2x+1)}{4} = 2x^2 + 4x + 2$

12 Unit test

1 Angle *JKL* = 100° **[1]**, angle *RPQ* = 60° **[1]**
Similar triangles must have identical angles **[1]** so triangles *JKL* and *PQR* are not similar **[1]**

2 Missing angle in D = 37° **[1]**, triangles A and D are congruent, SAS **[1]**

3 Scale factor = 2.5 (or equivalent) **[1]**, $x = 3.8$ cm **[1]** and $y = 6$ cm **[1]**

4 Angle *ABC* = angle *CDE* and angle *BAC* = angle *CED* (alternate angles)
Angle *ACB* = angle *DCE* (vertically opposite angles)
So triangles *ABC* and *CDE* are similar (AAA) **[1]**
Scale factor = 3.5 **[1]**, $x = 38.5$ cm **[1]**, $y = 9.4$ cm **[1]**

5 a Angle *ABE* = angle *ACD* and angle *AEB* = angle *ADC* (corresponding angles)
Angle *BAE* is common
So triangles *ABE* and *ACD* are similar, scale factor = $\frac{3}{4}$ **[1]**, $x = 9$ cm **[1]**

b Length *AC* = $7\frac{1}{3}$ cm **[1]**, $y = 1\frac{5}{6}$ cm or 1.8 cm (1 d.p.) **[1]**

6 a *AB* = *CD* and *AD* = *BC* (opposite sides in a rectangle are parallel and equal length) **[1]**
Angle *A* = angle *B* = angle *C* = angle *D* (all angles in a rectangle are 90°) **[1]**
So triangles *ABC*, *BCD*, *ACD* and *DAB* are congruent **[1]** (SAS) **[1]**

b *AB* = *DC* (opposite sides in a rectangle are parallel and equal length)
Angle *BAC* = angle *ACD* and angle *ABD* = angle *BDC* (alternate angles)
So triangles *ABE* and *DCE* are congruent (AAS)
AD = *BC* (opposite sides in a rectangle are parallel and equal length)
Angle *CAD* = angle *ACB* and angle *BDA* = angle *DBC* (alternate angles
So triangles *AED* and *CEB* are congruent (AAS)
Triangles *ABE*, *DCE*, *AED* and *CEB* are isosceles (base angles are equal)
So *AE* = *BE* = *CE* = *DE*.
Therefore *E* is the midpoint of both *AC* and *BD* **[2]**

7 Area scale factor B → C = 6.25 **[1]**, linear scale factor = $\sqrt{6.25}$ = 2.5 **[1]**
a = 5 cm **[1]**

8 Volume scale factor F → G = 3.375 **[1]**, linear scale factor = $\sqrt[3]{3.375}$ = 1.5 **[1]**, area scale factor = 1.5^2 = 2.25 **[1]**
Surface area of G = 33.75 m^2 **[1]**

9 Let the height of the complete cone be $h + 30$.
$\frac{h}{12} = \frac{h+30}{14}$ **[1]**
$14h = 12h + 360$
h = 180 cm **[1]**
Volume of complete cone = $\frac{1}{3} \times 14^2 \times (180 + 30) \times \pi = 13720\pi$ **[1]**
Volume of small removed cone = $\frac{1}{3} \times 12^2 \times 180 \times \pi$ (or $\left(\frac{12}{14}\right)^3 \times 13720\pi$) = 8640π **[1]**
Volume of frustum = $13720\pi - 8640\pi = 5080\pi$ = 15 600 cm^3 (3 s.f.) **[1]**

Sample student answer

a Drawing the relevant triangles next to each other, the same way up, makes it easier to match the corresponding angles to see if they are the same. It also avoids confusion with the other parts of the diagram.

b The student has explained each step of the answer clearly and separately to show how each angle was calculated, and has summarised a final proof statement.