**Solutions**

**5 Similar Shapes**

1. Linear scale factor = $\frac{9}{6} \rightarrow \frac{3}{2}$

   Volume: = $30 \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} = 101.25\ mls$

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2. Linear scale factor = $\frac{40}{50} \rightarrow \frac{4}{5}$

   Area: = $3.27 \times \frac{4}{5} \times \frac{4}{5} = 2.0928\ m^2$ = 2.09 m$^2$

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3. Linear scale factor = $\frac{27}{18} \rightarrow \frac{3}{2}$

   Cost: = $80 \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} = £2.70$

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4. Linear scale factor = $\frac{30}{20} \rightarrow \frac{3}{2}$

   Volume: = $0.8 \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} = 2.7\ litres$

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5. Linear scale factor = $\frac{24}{30} \rightarrow \frac{4}{5}$

   Volume: = $1.2 \times \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = 0.6144\ litres$

   Volume = 0.61 litres (2 sig figs)

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6. Linear scale factor = $\frac{200}{160} \rightarrow \frac{5}{4}$

   Cost: = $£1.12 \times \frac{5}{4} \times \frac{5}{4} \times \frac{5}{4} = £2.1875$

   Cost = £ 2.19

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**Similar Triangles**

1. Due to parallel line, Triangles are similar

   $\frac{BP}{6} = \frac{1}{1.5} \rightarrow BP = \frac{6}{1.5} = 4$

   Hence AP = 6 – 4 = 2 metres

   In Figure 2 the triangles are similar:

   Let B be h metres above the ground

   $\frac{h}{1} = \frac{6}{AP}$ but $AP = 2$ $\frac{h}{1} = \frac{6}{2}$ $h = 3\ metres$

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2. a) Use converse of Pythagoras in Δ ABX
   $AB^2 = 300^2 = 90000$
   $AX^2 + BX^2 = 180^2 + 240^2 = 90000$
   Since $AB^2 = AX^2 + BX^2$ then ∠ AXB is 90°
   So roads AX and BX are at right angles to one another

   b) Shortest route is AX → XC → CD
   Triangles ABX and XCD are similar
   ∠A = ∠D, ∠B = ∠C (alternate angles)
   So,
   $\frac{XC}{240} = \frac{750}{300} \rightarrow XC = \frac{750 \times 240}{300} = 600$
   Shortest distance = 180 + 600 + 750 m
   = 1530 metres = 1.53 km

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3. AC = 24 cm (diameter) and ∠ACD = 58°
   Using SOH-CAH-TOA,
   $\sin 58 = \frac{AD}{24} \rightarrow AD = 24 \sin 58 = 20.35\ cm$

   Δ AEO and ΔADC are similar (parallel line)

   $\frac{AE}{20.35} = \frac{12}{24} \rightarrow AE = \frac{1}{2} \times 20.35 = 10.175$

   Hence ED = 20.35 – 10.175 = 10.175 cm

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4. ∠B = 80° (angle sum triangle ABC)
   ∠E = 65° (angle sum triangle DEF)
   Triangles are equiangular, hence similar.

   $\frac{DE}{4.6} = \frac{10.5}{4.2} \rightarrow DE = \frac{10.5 \times 4.6}{4.2} = 11.5$
   Hence DE = 11.5 centimetres

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5. $\frac{BE}{6} = \frac{10}{12} \rightarrow BE = \frac{10 \times 6}{12} = 5$ cms

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6. $\frac{CD}{8.4} = \frac{3}{4.5} \rightarrow CD = \frac{3 \times 8.4}{4.5} = 5.6$ m

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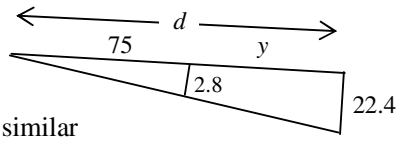
7. 


   The triangles are similar (parallel line).

   $\frac{d}{75} = \frac{22.4}{2.8} \rightarrow d = \frac{22.4 \times 75}{2.8} = 600\ cms$

   Hence y = 600 – 75 = 525 centimetres

   So, distance from top of 10p coin to top of person's head is 525 centimetres.

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