H4 *Congruence and Similarity* Activities

Activities

H4.1 Similar Shapes

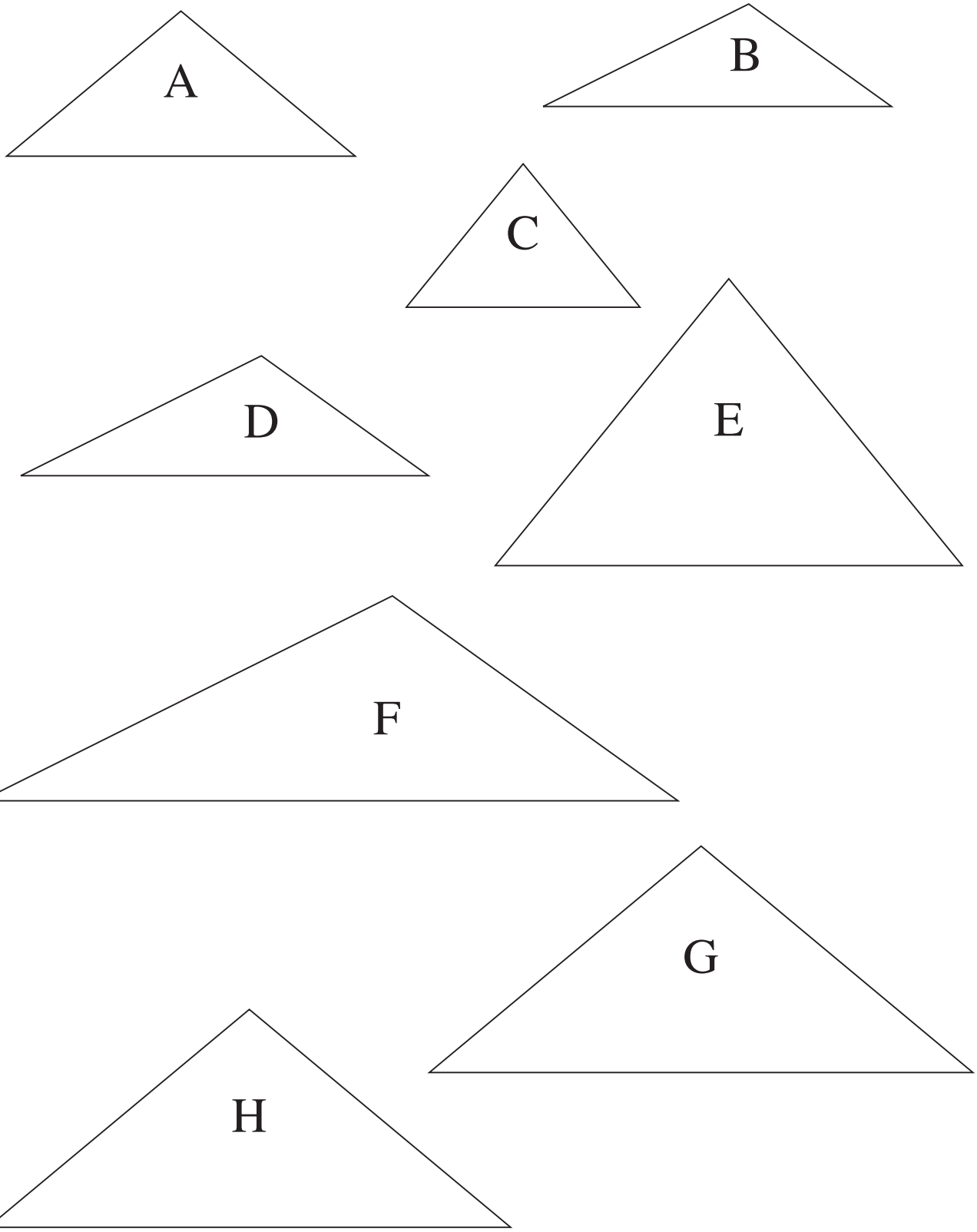
H4.2 How Far Away?

Notes and Solutions (1 page)

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ACTIVITY H4.1 *Similar Shapes*

Copy and cut out the triangles shown. Decide which are similar.



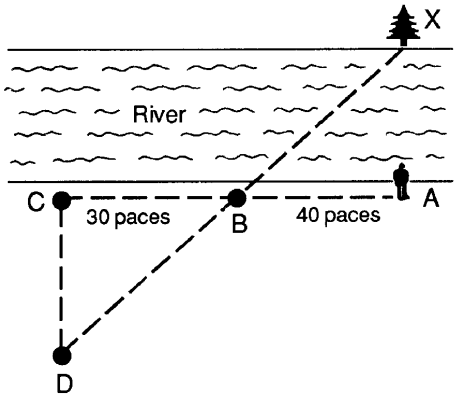
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ACTIVITY H4.2 *How Far Away?*

Pace Length Before you attempt the tasks below, you must find the length of your pace. To do this, it is best to walk at least 10 paces, measure the distance and divide by the number of paces.

DISTANCE

It is useful to be able to judge distances, and it is often not as difficult as you might think. Suppose, for example, you want to estimate the distance across a river. You can follow the procedure below:



- Find a landmark, say X, immediately opposite from you, A, on the other bank.
- Walk along your side of the river for, say, 40 paces, and mark the point with a stick, B.
- Walk on 30 paces to C, and walk inland to a point D so that DBX are in a straight line.
- Count the number of paces taken between C and D.

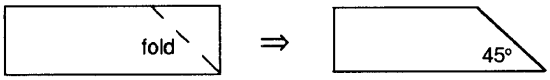
1. What can you say about triangles DCB and XAB ?
2. What is the ratio $\frac{XA}{CD}$? XA can now be found using this ratio.

HEIGHT

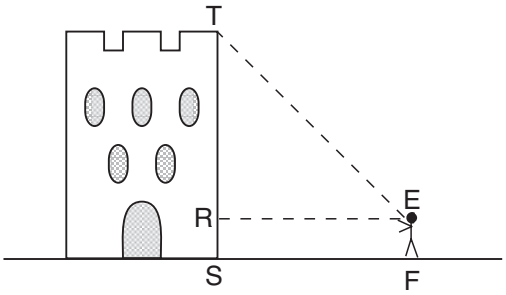
There is a similar method of estimating the height of a building or tower. You follow the procedure below, but first you need to make a *sight gauge*.

To Make a Sight Gauge

Fold a strip of card as shown opposite, to give a $45°$ angle.



- Starting at the foot of the tower, count the number of paces as you walk away.
- Stop walking when, looking along your sight gauge, you can see the top of the tower. (Make sure that you keep the gauge level.)



3. Why is $TR = RE$?
4. Explain why the height of the tower $\approx RE$ + your height .

Extension

1. Try out both these methods, and judge their accuracy.
2. Discuss other ways of estimating distances.

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ACTIVITIES H4.1 - H4.2 *Notes and Solutions*

Notes and solutions given only where appropriate.

H4.1 One method of deducing the answer is to measure the three sides of each triangle, list them and check which are in the same ratio.

Triangles A, G and H are similar.

Triangles B, D and F are similar.

Triangles C and E are similar.

Alternatively, the angles of each triangle can be measured and, where all 3 angles are the same, the triangles are similar.

H4.2 Students will need to know the length of their 'pace'.

- You might find it interesting to know that Roman soldiers could march 60 000 paces a day.
- *Leonardo Da Vinci* thought that in well-proportioned persons, their pace lengths should be about half their height.

1. The triangles are similar.

2. $\dfrac{XA}{CD} = \dfrac{BA}{BC} = \dfrac{40}{30}$, so $XA = \dfrac{4}{3} \times CD$

3. $TR = RE$ since TRE is a right-angled isosceles triangle $(\text{angle } RTE = \text{angle } RET = 45°)$.

4. The height of the tower $= TR + RS = RE +$ height of observer.

Extension Sight can be used to estimate distances but it is probably not a very accurate method.

Sound can sometimes be used. Sound travels at a speed of $333\ \text{ms}^{-1}$, so if there is some way to see an activity and to time how long it takes to *hear* the activity, we can use the formula

$$\text{distance (m)} = \text{time (s)} \times 330$$

For example, a lightning flash can be seen almost instantaneously, but it often takes some time for the thunder clap to be heard. (Every 5-second interval equates to about 1 mile distance.)

Another example is the time taken between seeing a starting pistol being fired (noting the smoke) and hearing the sound.

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