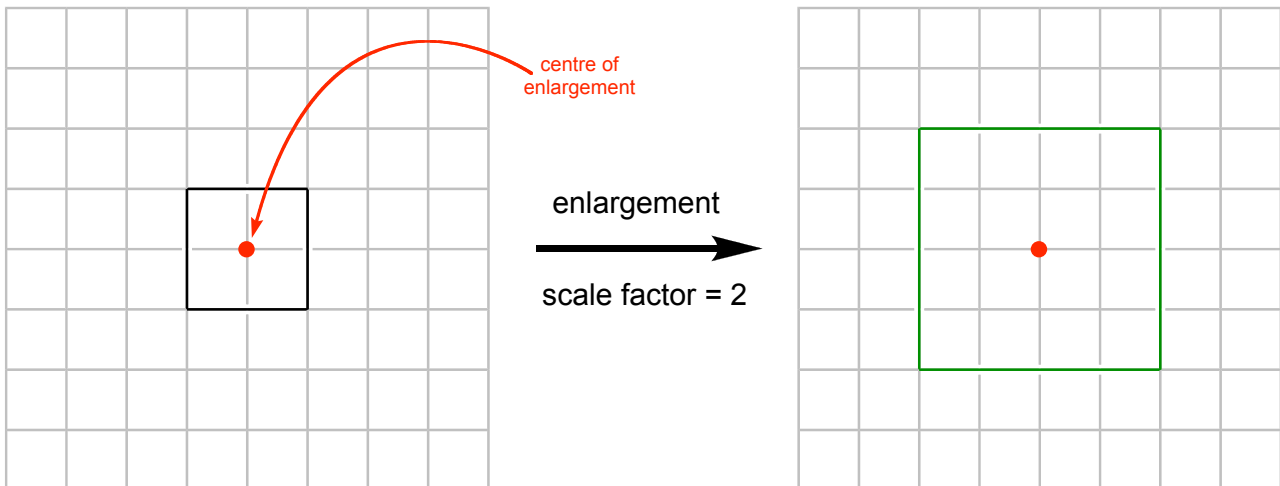


Enlargement

What's enlargement?

Enlargement, sometimes called scaling, is a kind of transformation that changes the size of an object. The image created is **similar*** to the object. Despite the name enlargement, it includes making objects smaller.

*Shapes are equal if their corresponding angles are equal. Their corresponding sides are then in the same ratio.



For every enlargement, a **scale factor** must be specified. The scale factor is how many times larger than the object the image is.

$$\text{length of side in image} = \text{length of side in object} \times \text{scale factor}$$

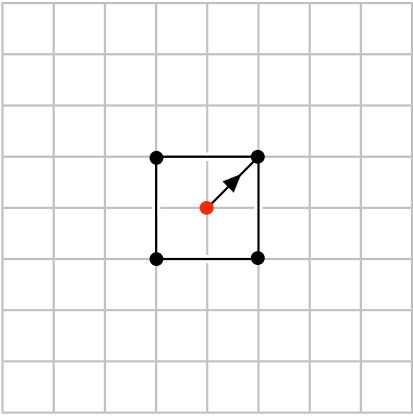
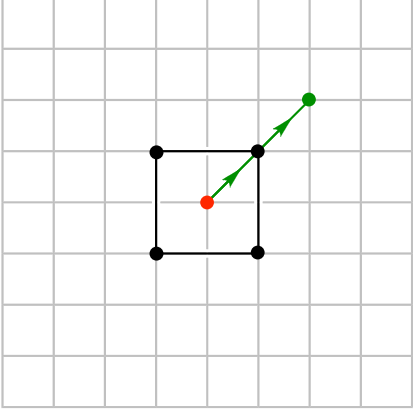
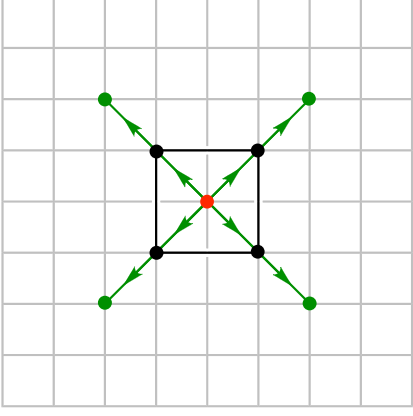
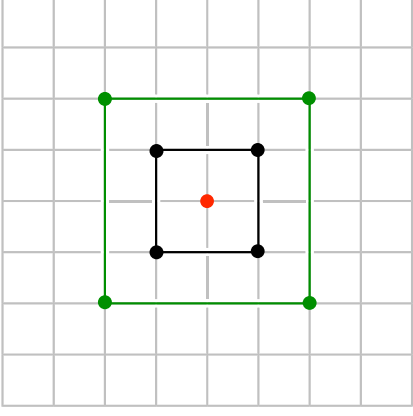
For any enlargement, there must be a point called the **centre of enlargement**.

$$\text{distance from centre of enlargement to point on image} = \text{distance from centre of enlargement to point on object} \times \text{scale factor}$$

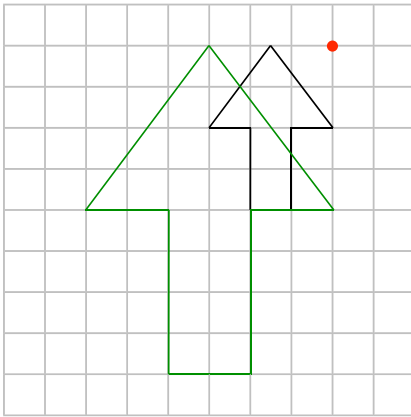
The centre of enlargement can be anywhere, but it has to exist. If you are asked to enlarge an object in an exam, the question will always tell you which centre of enlargement to use.

How do I actually find and draw the enlarged image?

Enlargement always involves the same step-by-step process.

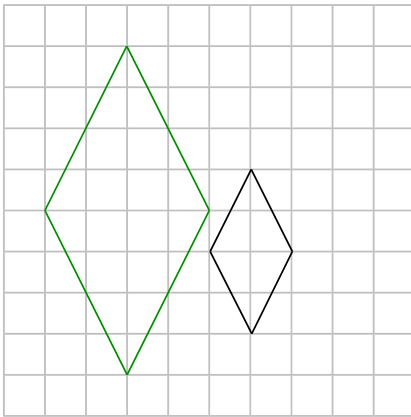
	<p>Step 1 Find the distance from the centre of enlargement to a point on the object.</p> <p>In the example above, the centre of enlargement is the red point at the centre of the square. The distance to one corner of the square is one diagonal unit.</p>
	<p>Step 2 The distance to the equivalent point on the image is the original distance times the scale factor.</p> <p>The direction is the same as in step 1.</p> <p>In the example above, the scale factor is 2, so the new distance is double the original distance.</p>
	<p>Step 3 Repeat steps 1 and 2 for each point on the object, or at least until you have enough points to draw the image.</p>
	<p>Step 3 Join your image points up with lines to draw the image (the enlarged square).</p>

Frequently asked questions



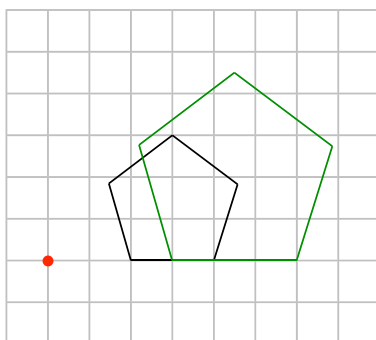
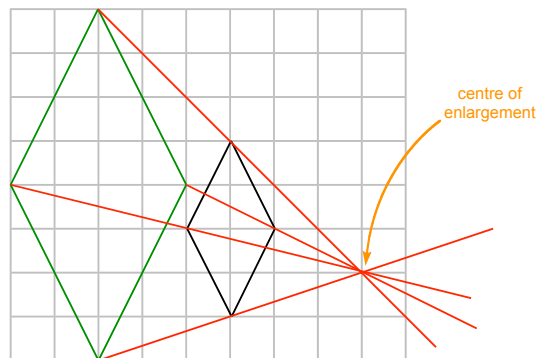
Is the centre of enlargement always at the centre of the object?

No, it can be anywhere. The question will specify where it is.



A question gives me both the object and the image, and asks me to find the centre of enlargement. What do I do?

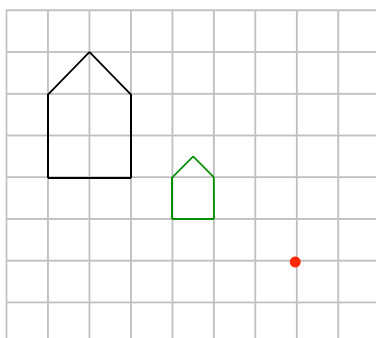
Draw straight lines from each point on the image, through its corresponding point on the object, and continuing for a little further. The point where all the lines cross is the centre of enlargement.



Does the scale factor have to be an integer (a whole number)?

No. In fact, you are required to be able to perform enlargements with fractional scale factors. The method is almost identical for both – just multiply your centre-of enlargement-to-object distance by the fraction to give the centre-of enlargement-to-image distance

If the scale factor is greater than 1, the image is larger than the object. In the upper example on the left, the scale factor is 1.5 (or $\frac{3}{2}$ if you prefer it as a fraction).



If the scale factor is less than 1, the image is smaller than the object. This confuses some people because although it is called enlargement, the shape is actually made smaller. The lower example to the left has a scale factor of 0.5 (or $\frac{1}{2}$) – the image is half the size of the object.

No grid? Use the ray method.

Enlargements can be done on plain paper. However, you can't count squares when there aren't any! In this case, use the **ray method**. You can use the ray method even if you do have a grid.

	<p>Step 1 With a ruler, a straight line from the centre of enlargement to each point on the object.</p>
	<p>Step 2 Again using a ruler, measure the distance from the centre of enlargement to a point on the object.</p>
	<p>Step 3 Multiply the distances from step 2 by the scale factor.</p> <p>In the example to the left, the scale factor is 3 so each distance is tripled.</p> <p>Draw new lines from the centre of enlargement, passing through each point on the object and continuing until they have the new length.</p> <p>Put a point at the end of each new line.</p>
	<p>Step 4 Join up the points at the ends of the new lines from step 3. These points are the vertices of the image (the enlarged shape).</p>
	<p>Step 5 That's it! You now have an object and an enlarged image.</p>