

Estimating Angles using Referent Angles

Estimations are made in many trades that use angles. Imagine that you are working as a tradesperson in the situations below and make the following estimations (aim to be within 5°).

a) a landscaper estimating the angle of the corner of a garden bed *Acute* 50°

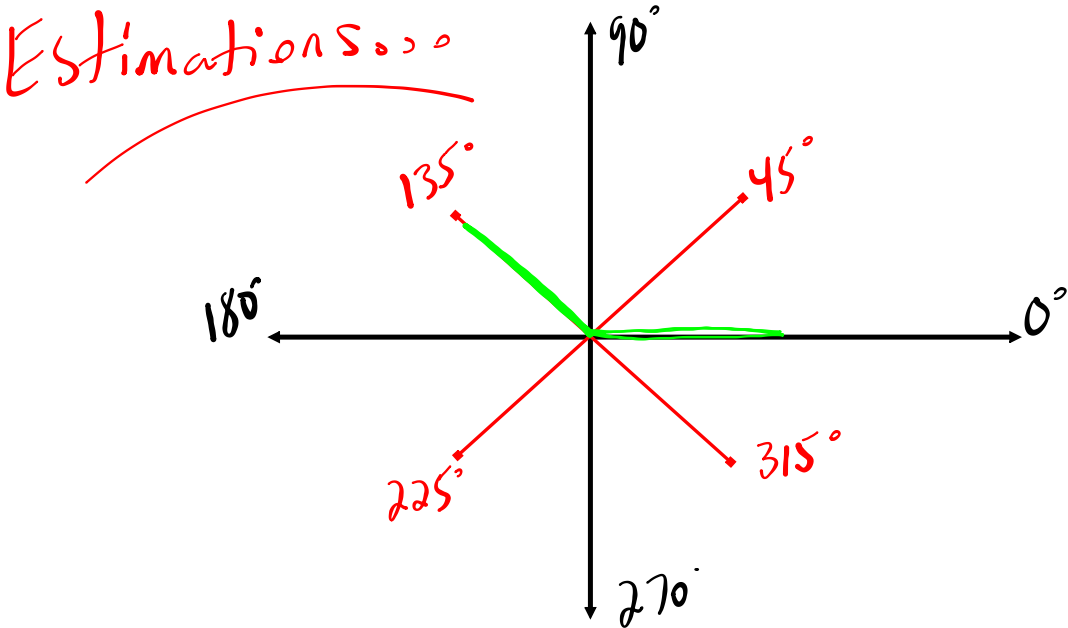
b) a surveyor estimating the angle of a property boundary line on a map *Reflex* 220°

c) a roofer estimating the angle of the peak of a roof *Obtuse* 165°

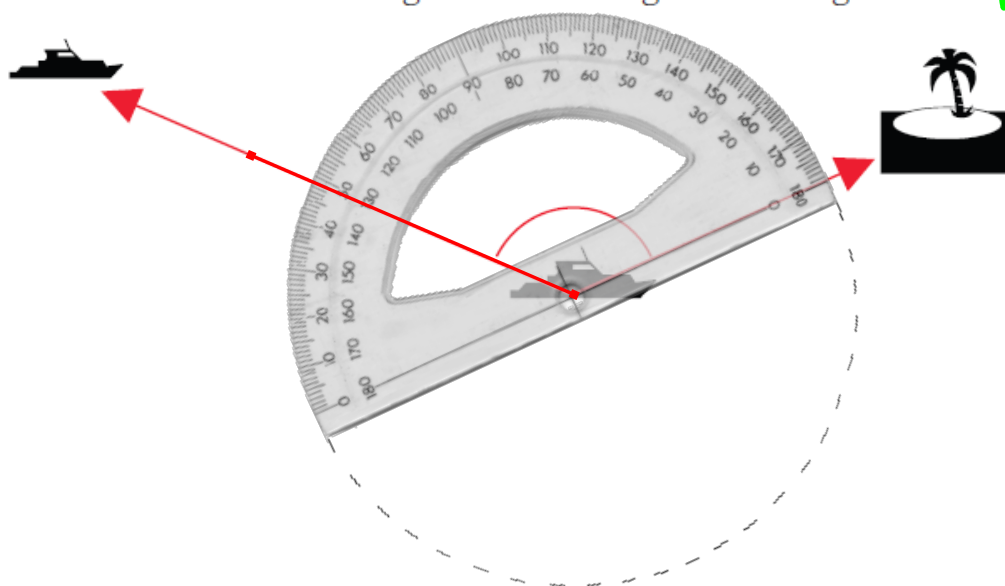
d) a cabinet-maker estimating the angles of two corners of a shelf

SOLUTION

- a) Students will be able to recognize a 90° angle without measuring, so they should be able to look at this angle and estimate it to be slightly less than 90° . They might also compare it to a real-life example of 90° , such as a corner. They will probably rotate the page on which the diagram appears, to position the angle so that one of the rays is horizontal, which will show clearly that the angle is an acute angle, less than 90° . A close estimate would be within 76° to 80° .
- b) Students will be able to see instantly that this angle is more than 180° , but not quite big enough to add another 45° . So they may describe it as “a straight angle (180°) plus about a bit less than one-half of a right angle (45°)”, and come up with a close estimate of 219° to 223° .
- c) Students will see that this is greater than 90° but not quite wide enough to add another 45° . They will be able to suggest a close estimate of around 130° .
- d) The acute angle in the top left corner can be seen to be a 45° angle by using a referent. The obtuse angle in the lower left corner can be seen to be a right angle plus a little more than a 45° angle so a close estimate will be about 145° .



Estimate the measure of this angle without using a measuring device. 130°



Example 1

Use a ruler and compass to create the following angles.

- a) Draw a 90° angle.
- b) Replicate any existing angle.

Angle Constructions... 1) Perpendicular Bisector

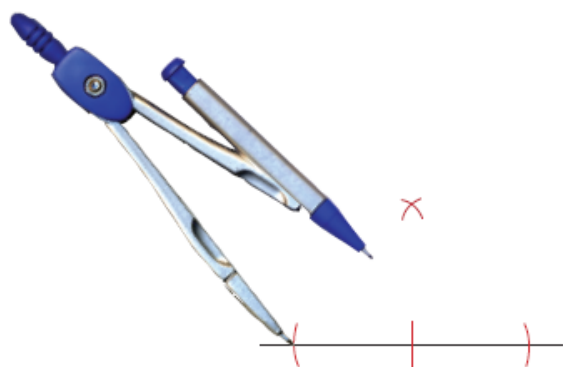
STEP 1:

Put the compass point at the mark you made. Open the compass slightly and make two more marks on each side of the first mark. Ensure they are the same distance from the first mark.



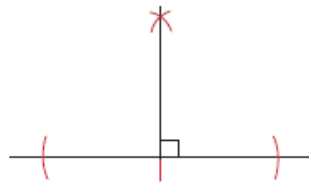
STEP 2:

Widen the compass a bit more, and place the compass point at one of the new marks. Make a small arc, then do the same thing after placing the compass point at the other new mark. Ensure the two arcs intersect each other.

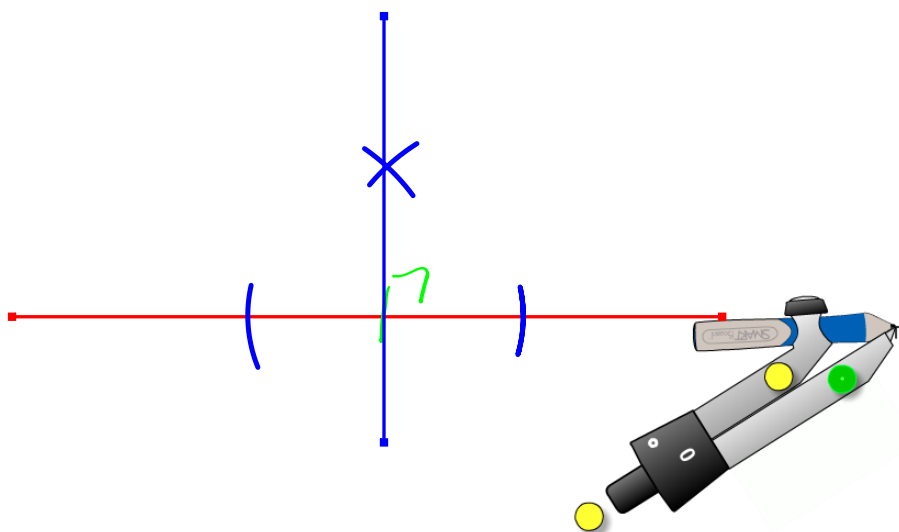


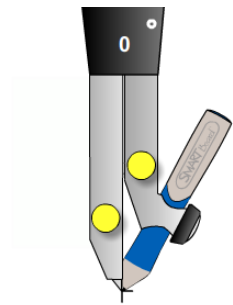
STEP 3:

Draw a line segment that goes between or through the point where the arcs intersect and the first mark you made. The two line segments are perpendicular to each other, and therefore form a 90° (right) angle.



① Constructing a 90° angle



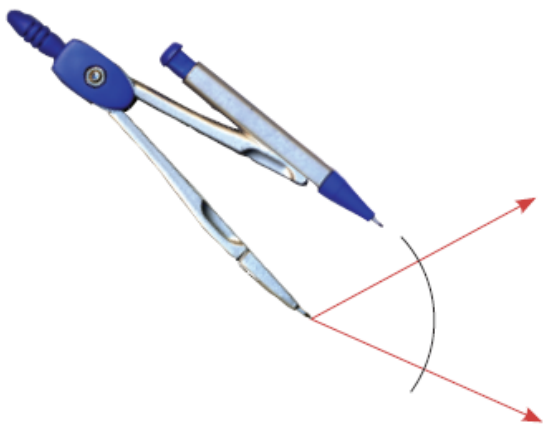


Angle Constructions... 2) Replicate an Angle

STEP 1:

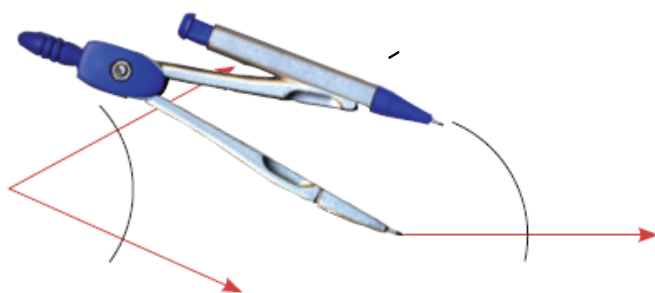
b) To replicate any existing angle, follow these steps.

Use a compass to lightly draw an arc centred at the vertex of the original angle.



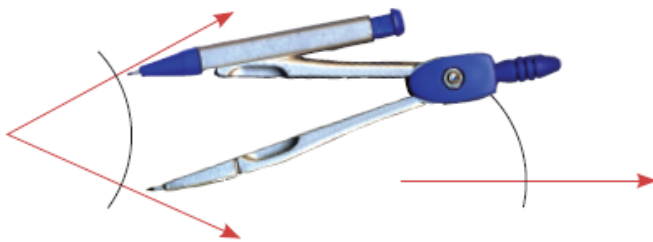
STEP 2:

Use a ruler to draw one side of the new angle, and draw an arc of the same radius and arc length as the one you just drew on the original angle.



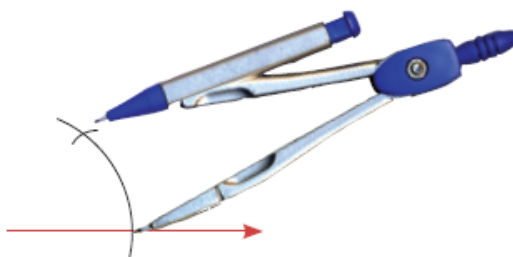
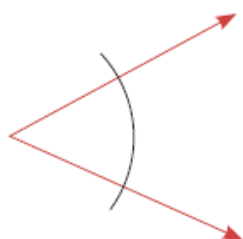
STEP 3:

Bring the compass up to the original angle, and set it so that its point and the tip of the pencil touch the points where the original arc intersects the sides of the angle.



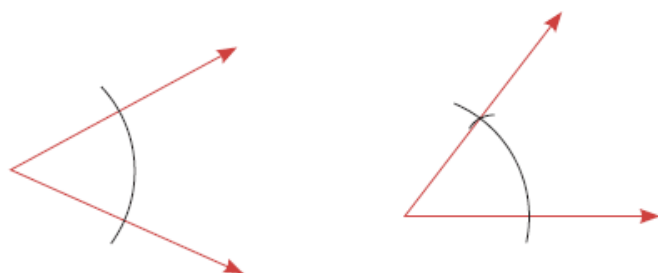
STEP 4:

Place the compass point over to the point of intersection of the side of the new angle and the new arc. Draw a short arc through the new arc.

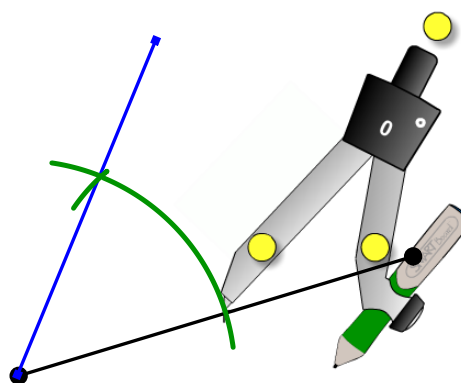
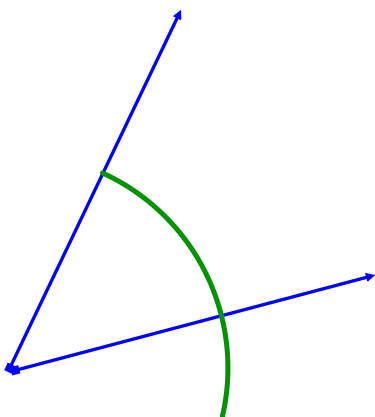


STEP 5:

Use the ruler to draw the other side of the angle, from the left end of the first side (the vertex) through the point of intersection of the two arcs. The result is a new angle with the same measure as the original.



② Replicate an angle



How Can We Bisect An Angle???

angle bisector: a segment, ray, or line that separates two halves of a bisected angle

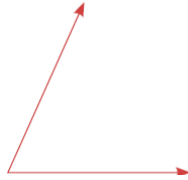
Method #1 - Paper Folding

Method #2 - Protractor and straight edge

Method #3 - Compass and straight edge

Example

Accurately bisect an angle like the one shown here.



SOLUTION

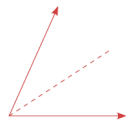
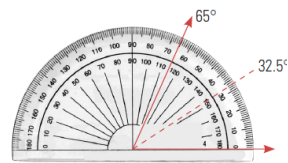
Measure the angle using a protractor. Divide that measure by 2.

The angle measure is 65°.

$$65 \div 2 = 32.5$$

Use a protractor to measure and mark off a 32.5° angle.

Draw a line segment from the vertex to the mark you made.



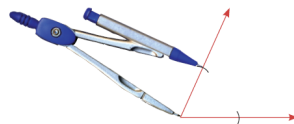
The angle has been successfully divided into two equal parts.

ALTERNATIVE SOLUTION

Trace the angle on above onto a sheet of paper. Place one side of the angle over the other side, creating a fold that goes through the vertex of the angle. The angle has been successfully divided into two equal parts.

ALTERNATIVE SOLUTION 2

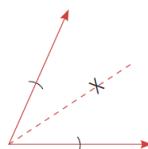
Replicate the angle drawn in the previous solution. Set a compass so that the gap between the pivot point and pencil is a few centimetres. Put the pivot point on the vertex. Mark each side of the angle with the pencil.



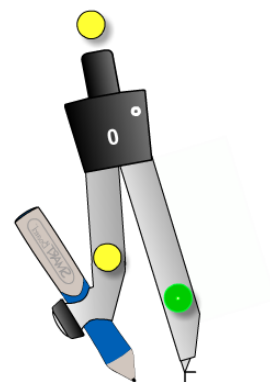
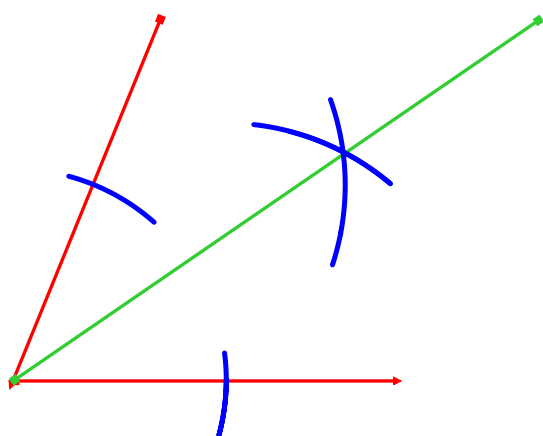
Adjust the compass so that the gap between the pivot point and pencil is over half the distance between the two marks on the sides of the angle. Put the pivot point on one mark and mark off a short arc inside the angle. Put the pivot point on the other mark and mark off another short arc inside the angle, to intersect with the first arc.



Draw a line segment from the vertex to the point of intersection.



③ Angle Bisector

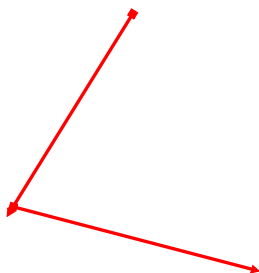


Your turn...

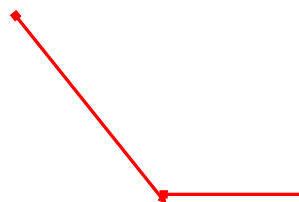
① 90° angle




② Replicate an angle



③ Bisect an angle



HOMEWORK...

 Worksheet - Measuring, Drawing & Estimating Angles (7.1).pdf

Do #1 - 4

Be able to construct...

- 1) 90 degree angle
- 2) Replicate an angle
- 3) Bisect an angle

Attachments

Worksheet - Measuring, Drawing & Estimating Angles (7.1).pdf