7.2 - Angle Bisectors and Parallel Lines

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Students at the Hungry Heart Café learn how to work in a restaurant kitchen from chef Kathy Jaeger.

MATH *ON THE JOB*

The Hungry Heart Café is a unique restaurant in St. John's, Newfoundland. Founded by Stelle Burry Community Services, the Hungry Heart Café is both a restaurant and a job-training program for people who have experienced significant personal troubles including abuse, addictions, violence, and incarceration.

Chef Kathy Jaeger was instrumental in creating the Hungry Heart Café program. As a teacher, she gives her students classroom work, on the job training, and life skills development. "My main duties include instructing students in all aspects of introductory restaurant cooking and catering in hopes that it will improve their prospects for employment. I am also responsible for overall food production of the Café and staff supervision."

Originally from Ontario, but with family ties to the Maritimes, Kathy received her culinary training at George Brown College in Toronto, has her national certification in Food Safety Training from the Canadian Restaurant and Food Service Association, and her Red Seal certification. She uses math to calculate food, beverage, and labour costs; to measure ingredients using volume and weight measures; to order supplies and calculate menu pricing; to cut and slice foods proportionately; to calculate and track inventory; and to calculate conversions between imperial and SI units.

The Hungry Heart Café has been asked to cater a fundraising dinner, featuring apple pie for dessert.

1. If there are 60 guests, and Kathy bakes 10 pies, how many slices of pie will Kathy need to cut out of each pie to make sure there is a piece of pie for each guest?
2. What will be the approximate size of the central angles of the pieces of pie?
3. One of the guests wants only half a piece of pie. What would be the approximate size of the central angle of the half-piece of pie?

Solutions...

1. To calculate how many pieces of pie there will be in each pie, students will need to divide the number of guests by the number of pies.

   $60 \div 10 = 6$ pieces of pie

2. One pie is equal to 360°. Divide by the number of pieces.

   $360° \div 6 = 60°$

   The central angles of the pieces of pie will each be 60°.

3. Divide the size of the angle of a full slice by 2.

   $60° \div 2 = 30°$

   The central angles of the children's pie pieces will be 30°.

How Can We Bisect An Angle???

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

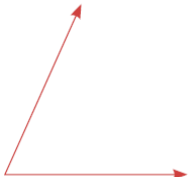
Method #1 - Paper Folding

Method #2 - Protractor and straight edge

Method #3 - Compass and straight edge

Example

Accurately bisect an angle like the one shown here.



SOLUTION

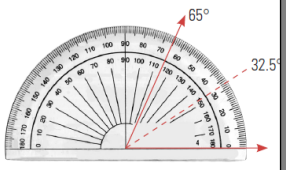
Measure the angle using a protractor. Divide that measure by 2.

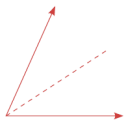
The angle measure is 65°.

65 ÷ 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.





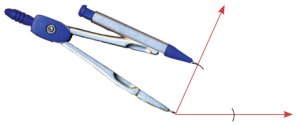
The angle has been successfully divided into two equal parts.

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.

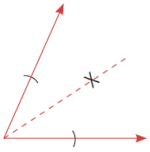
ALTERNATIVE SOLUTION 2

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.

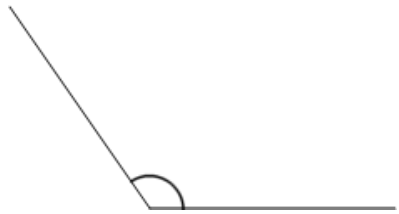


Adjust the compass so that the gap between the pivot point and pencil is over half the distance between the two marks on the sides of the angle. Put the pivot point on one mark and mark off a short arc inside the angle. Put the pivot point on the other mark and mark off another short arc inside the angle,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

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



Let's TRY one more...



THE ROOTS OF MATH

GEOMETRIC PERSPECTIVE IN ART

The School of Athens, completed by Raphael in 1511, is famous for its use of perspective.

Panels painted with olive trees and placed behind stage actors were some of the first artistic attempts to make closer objects appear larger and distant objects appear smaller, or to produce perspective. This occurred in fifth-century Greece. Medieval and Byzantine art also incorporated perspective in paintings.

Renaissance artists such as Michelangelo are most frequently celebrated for their use of perspective, since they were the first to use the same principles of perspective and scale that artists use today. Between the fourteenth and seventeenth centuries, Renaissance artists used geometric perspective to create the appearance of three-dimensional space within two-dimensional paintings.

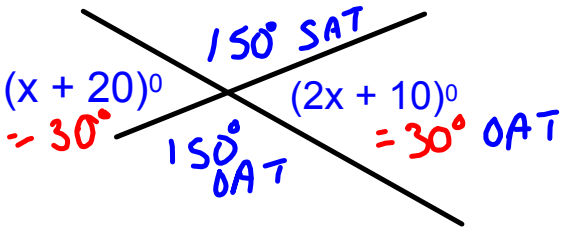
Geometric perspective uses four elements to create a three-dimensional effect, the first being a horizon line. It is often found at the viewer's eye level, and represents the horizon. The second is a vanishing point, a spot on the horizon line where the parallel lines in the painting converge and seem to disappear. Perspective lines—those drawn from the edges of objects and leading back into the distance—and angular lines are also used. Geometric scale also allows artists to create perspective by accurately representing the size of one object in relation to another.

1. Think about a photograph you took, a painting you like, or a poster you own. In what ways does it represent geometrical perspective? Identify parallel lines, a vanishing point, or a horizon line that it contains.
2. How could a picture have more than one vanishing point? Is it possible for a picture not to have a vanishing point? Explain your reasoning.
3. How would you define the term "parallel lines"? Describe a method you could use to prove whether or not two lines are parallel.

STUDENT BOOK, p. 297

1. Many artworks and photographs use geometrical perspective as the basis for their composition. Ask students to describe their suggestions, bring in images of them, or look them up on the internet. Then ask them to describe where the parallel lines and horizon line are (these may be imaginary, that is, the artists may have used them to compose the work only) and where the vanishing point is in the work they've chosen.
2. Pictures can contain more than one vanishing point or no vanishing point.
3. From previous learning, students should be able to define parallel lines as lines on the same plane that never intersect and are always the same distance apart at any given point. They may suggest that to prove they are parallel, a line perpendicular to the parallel lines will meet at a right angle to both lines.

Find the missing angles.



$2x + 10 = x + 20$

$2x - x = 20 - 10$

$x = 10$

$2x + 10 = 2(10) + 10$

$= 20 + 10$

$= 30$

HOMEWORK...

- Do Activity 7.4 on p. 290
- Build Your Skills #1 - 7 on p. 292

7.2 - Build Your Skills Detailed Solutions.pdf

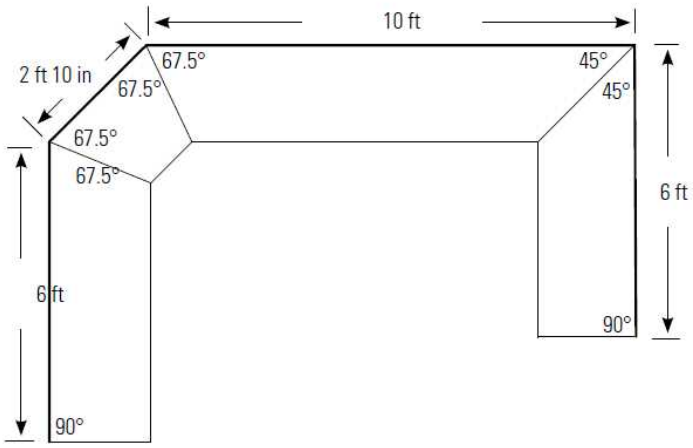
ACTIVITY 7.4

DRAW A KITCHEN COUNTERTOP PLAN

STUDENT BOOK, p. 290

In this activity, students develop their visualization skills, to imagine or sketch the countertop, as well as their reasoning skills, to deduce that they will need four differently shaped countertop pieces. They will also deduce that, in order to be systematic, they can work from start to finish, but that this is not strictly necessary.

SOLUTION



Attachments

7.2 - Build Your Skills Solutions.pdf