

The Geometry / Honors Geometry Semester B examination is based on the following goals, expectations and indicators for Units 5-9.

Goal 2: Geometry, Measurement, And Reasoning

The student will demonstrate the ability to solve mathematical and real-world problems using measurement and geometric models and will justify solutions and explain processes used.

2.1 Expectation: The student will represent and analyze two- and three-dimensional figures using tools and technology when appropriate.

Indicators (Note: *Italics designates an honors level indicator.*)

2.1.1 analyze the properties of geometric figures.

2.1.1.b represent and analyze line/segment/plane relationships including parallel, perpendicular, intersecting, bisecting, midpoint, median, and altitude.

2.1.1.e represent and analyze angle relationships with parallel lines.

2.1.1.g represent and analyze geometric solids including cones, cylinders, prisms, pyramids, and composite figures.

2.1.1.h represent and analyze circles and spheres including radius, diameter, chord, tangent, secant, central/inscribed angle, inscribed and circumscribed.

2.1.2 identify and/or verify properties of geometric figures using the coordinate plane and concepts from algebra.

Properties and relationships include:

2.1.2.a line/segment relationships including parallel, perpendicular, intersecting, bisecting, midpoint, median, and altitude.

2.1.2.e circle including radius, diameter, tangent, and chord.

2.1.2.1 apply properties of transformation using coordinate geometry.

2.1.3 use transformations to move figures create designs, and/or demonstrate geometric properties.

Transformations include:

2.1.3.a reflections, rotations, translations and dilations

2.1.3.1 describe the solid figure formed when a plane figure is rotated about a line.

2.1.4 construct and/or draw and/or validate properties of geometric figures using appropriate tools and technology.

Properties and relationships include:

2.1.4.d polygons including regular, non-regular, equilateral, and equiangular.

2.1.4.1 solve problems using constructions

2.1.4.2 define and illustrate locus of points in both two and three dimensions.

2.2. Expectation: apply geometric properties and relationships to solve problems using tools and technology when appropriate.**Indicators****2.2.1 identify and/or verify congruent and similar figures and/or apply equality or proportionality of their corresponding parts.**

2.2.1.b identify and/or verify similar figures and/or apply proportionality of their corresponding parts.

2.2.1.c apply the properties of similar figures to area and volume problems.

2.2.2 solve problems using two-dimensional figures and/or right-triangle trigonometry.

2.2.2.a identify and evaluate the sine, cosine and tangent ratios for an acute angle of a right triangle

2.2.2.b apply right triangle trigonometry to solve real world problems.

2.2.2.c solve problems using the Pythagorean Theorem

2.2.2.d solve problems involving special right triangles including the relationships $(30^\circ; 60^\circ; 90^\circ)$ and $(45^\circ; 45^\circ; 90^\circ)$.

2.2.2.1 *apply the Law of Sines and the Law of Cosines to solve problems involving oblique triangles.*

2.2.2.2 *determine the sine, cosine and tangent for a rotational angle.*

2.2.2.3 *solve problems using vectors.*

2.2.3 use inductive or deductive reasoning.

2.2.3.1 prove properties of triangles and quadrilaterals using coordinate geometry.

2.3 Expectation: apply concepts of measurement using tools and technology when appropriate.

Indicators

2.3.1 use algebraic and/or geometric properties to measure indirectly.

2.3.1.a apply properties of proportionality and similarity to solve problems involving indirect measurements.

2.3.1.1 determine the positive geometric mean between two numbers.

2.3.1.2 *apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle.*

2.3.2 use techniques of measurement and will estimate, calculate, and/or compare perimeter, circumference, area, volume, and/or surface area of two-and three-dimensional figures and their parts.

2.3.2.a apply techniques of measurement involving two-dimensional shapes, including polygons, circles and composite figures.

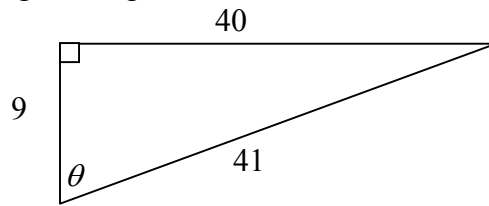
2.3.2.b apply techniques of measurement involving three-dimensional shapes, including cubes, prisms, pyramids, cylinders, cones, spheres, and composite figures.

2.3.2.c apply geometric properties and relationships.

2.3.2.1 calculate the length of a given arc of a circle.

2.3.2.2 solve problems using the areas of segments and sectors of circles.

1. Look at the right triangle below.



Note: Figure NOT drawn to scale

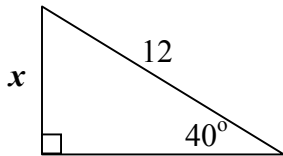
Which of the following has a ratio of $\frac{40}{41}$?

- A $\sin \theta$ B $\cos \theta$ C $\tan \theta$ D None of these

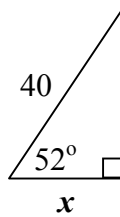
For problems 2-7, determine the value of x and/or y in each figure below.

Note: Figures NOT drawn to scale

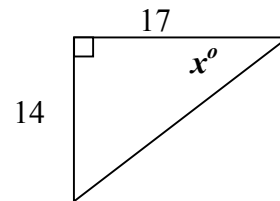
- 2.



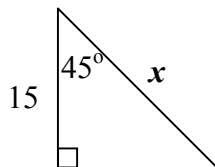
- 3.



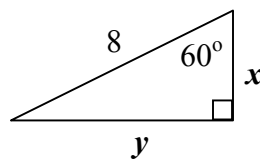
- 4.



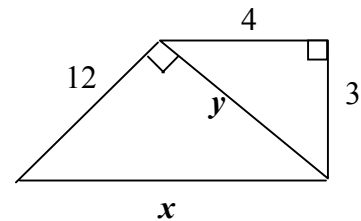
- 5.



- 6.



- 7.



8. A jet plane begins a steady climb flies for 3 miles (15840 feet) at an angle of 12° . What was its change in altitude in feet?

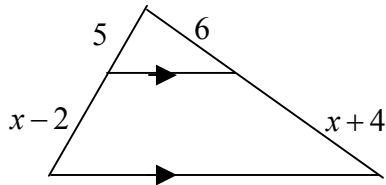
9. A regular hexagon has an area of $96\sqrt{3}$ and an apothem of $4\sqrt{3}$. What is the length of each side of the hexagon?

- A 2 B 4 C 8 D $8\sqrt{3}$

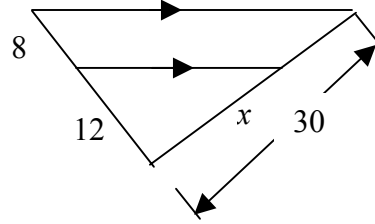
10. Determine the value of x in each figure below.

Note: Figures NOT drawn to scale

a.



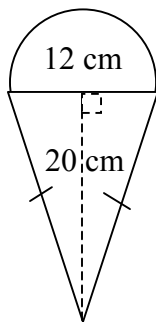
b.



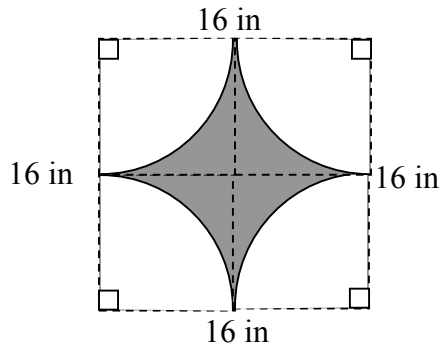
Determine the area of the following composite figures. If the figure is shaded, find the area of the shaded portion of the figure.

Note: Figures NOT drawn to scale

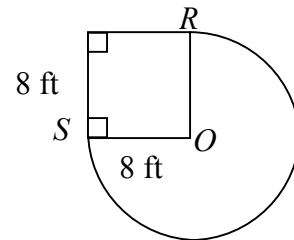
11.



12.



13. \overline{OR} and \overline{OS} are radii



For problems 14-16, the lengths of three segments are given. In each case determine whether a triangle can be formed with the three segments. If so, state whether the triangle would be acute, right, or obtuse.

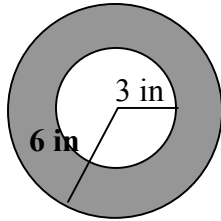
14. 6, 8, 10

15. 3, 8, 9

16. 9, 12, 14

For problems 17-18, determine the probability that a dart will hit the shaded area of the target.

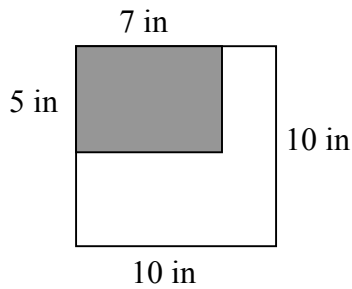
17.



Note: Figure NOT drawn to scale

- A $\frac{1}{4}$ B $\frac{1}{3}$ C $\frac{1}{2}$ D $\frac{3}{4}$

18.



Note: Figure NOT drawn to scale

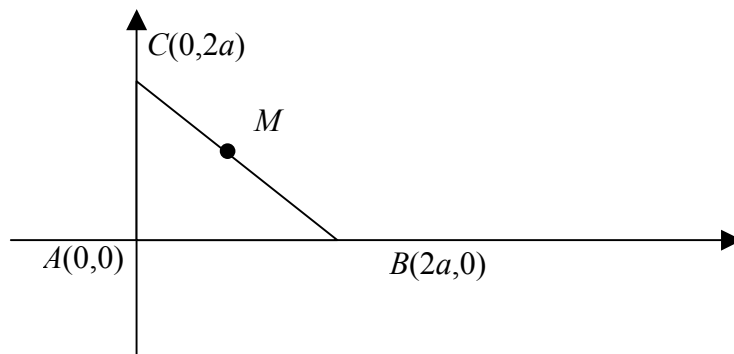
- A $\frac{7}{20}$ B $\frac{3}{5}$ C $\frac{13}{20}$ D $\frac{7}{10}$

19. Complete the following coordinate proof.

BCR

Given: Right Isosceles triangle ABC with coordinates as shown.

Prove: *The median to the hypotenuse of an isosceles right triangle is perpendicular to the hypotenuse.*

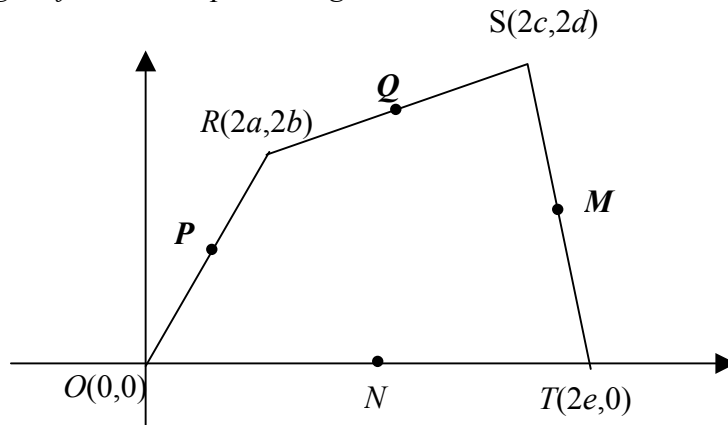


20. Complete the following coordinate proof:

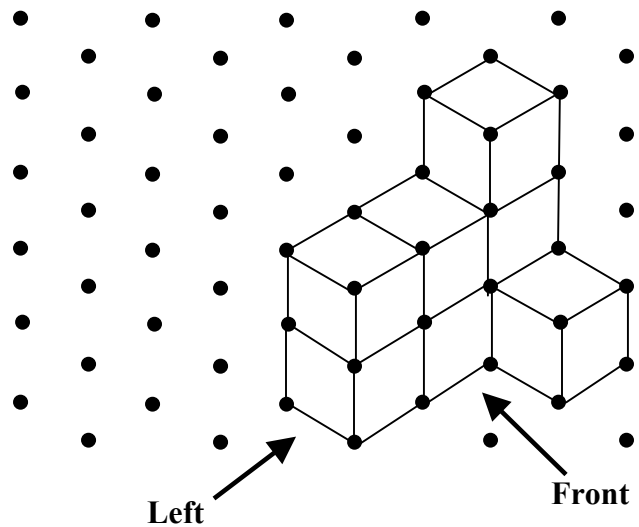
ECR

Given: Quadrilateral $ROTS$ with vertices as labeled below.

Prove: *If the midpoints of the sides of a quadrilateral are connected, then the figure formed is a parallelogram.*



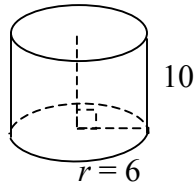
21. Draw the six views (front, left, right, back, top, and bottom) for the figure represented below that is made up of 8 cubes.



For problems 22-25, give the complete name for the solid, then determine the surface area and/or volume of the solid.

Note: Figures NOT drawn to scale

22.

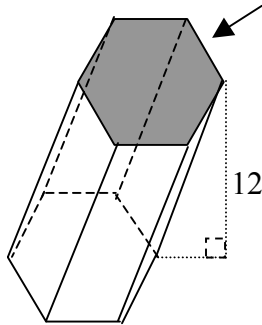


Complete Name : _____

Surface Area: _____

Volume: _____

23.



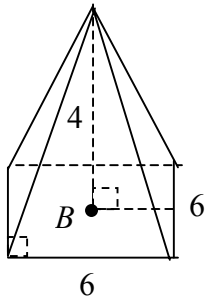
A regular hexagon with perimeter = 36
and area = $54\sqrt{3}$

Complete Name : _____

Compute Volume only!

Volume: _____

24.



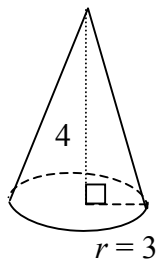
Point B is at the center of the square base.

Complete Name : _____

Surface Area: _____

Volume: _____

25.

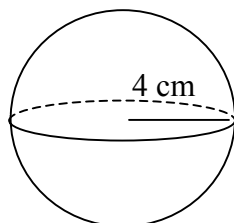


Complete Name : _____

Surface Area: _____

Volume: _____

25a.



Complete Name : _____

Surface Area: _____

Volume: _____

26. The ratio of the surface areas of two similar solids is 25:36. What is the ratio of their volumes?

- A 5:6 B 25:36 C 125:216 D 625:1296

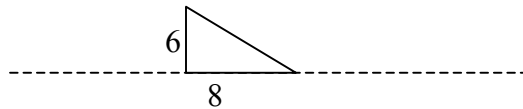
27. If the radius of a sphere is tripled, what will happen to the surface area of the sphere?

- A It will increase by a factor of 3.
 B It will increase by a factor of 6.
 C It will increase by a factor of 9.
 D It will increase by a factor of 27.

28. If the radius of a cylinder is doubled, and its height is tripled, what will happen to the volume of the cylinder?

- A It will increase by a factor of 3.
 B It will increase by a factor of 6.
 C It will increase by a factor of 12.
 D It will increase by a factor of 18.

29. The figure below is rotated about the dashed line to form a solid. What kind of solid is formed? What is the volume of the solid?

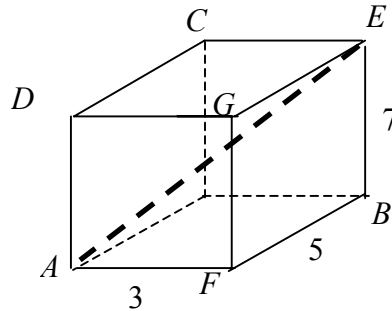


30. Donna wants to put a ceramic castle, whose volume is 350 cm^3 , and a plastic scuba diver, whose volume is 250 cm^3 in her aquarium as decoration. The aquarium measures $40 \times 30 \times 30 \text{ cm}$ high. The water is 2 cm from the top before she puts the items in.

ECR

- Will the water overflow the top of the aquarium? Use mathematics to justify your answer.

31. Look at the right rectangular prism below.

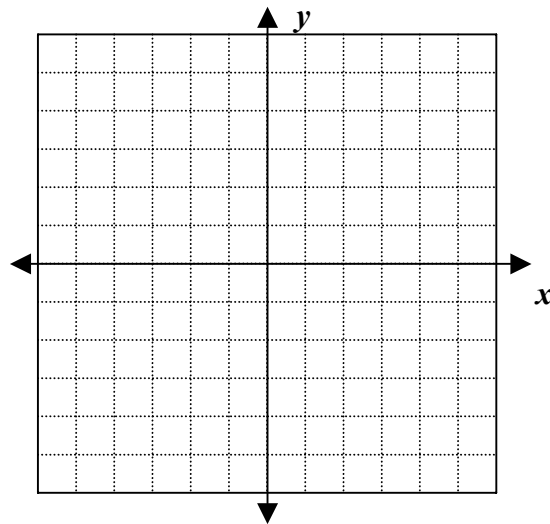


What is the length of segment \overline{AE} ?

32. A cube has a surface area of 24 in^2 . What is the volume of the cube?

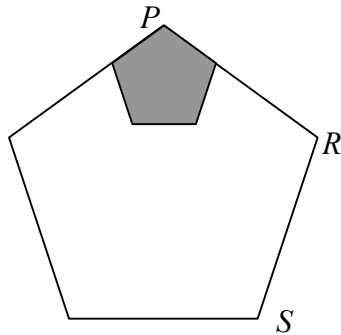
33. On the coordinate plane below, plot the points $A(-1,2)$, $B(0,1)$, and $C(2,3)$

ECR



- Is the triangle right, acute, or obtuse? Use mathematics to justify your answer.
- Using $(0,0)$ as the center of dilation and a scale factor of 2, draw the dilation image and state the coordinates of each vertex of the image.
- What is the ratio of the area of the dilation image to the pre-image? Use mathematics to justify your answer.

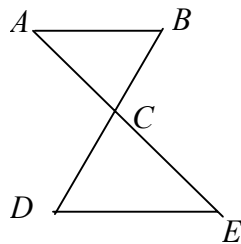
34. The shaded regular pentagon below has a perimeter of 40. It is dilated with a scale factor of 3, with the center of dilation P .



Note: Figure NOT drawn to scale

What is the length of \overline{RS} ?

35. Look at triangles ABC and DCE below.



Note: Figure NOT drawn to scale

In parts (a), (b), and (c) below, determine whether the triangles are similar, based on the given information. Use mathematics to justify your answer.

- a. $\overline{AB} \parallel \overline{DE}$
- b. $BC = 14, AC = 16$
 $DC = 21, CE = 24$
- c. $AB = 10, BC = 20$
 $DE = 20, CD = 40$
36. What is the geometric mean of 6 and 12?

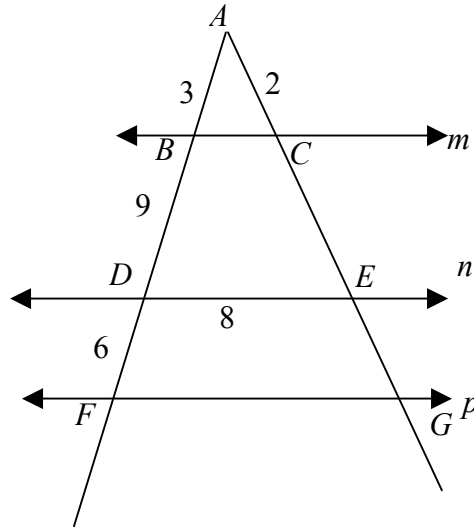
- A** $\sqrt{2}$ **B** $\sqrt{72} = 6\sqrt{2}$ **C** 18 **D** 72

37. If 6 is the geometric mean of 2 and x , what is the value of x ?

- A 3 B 4 C 12 D 18

38. In the figure below, $m \parallel n \parallel p$.

BCR

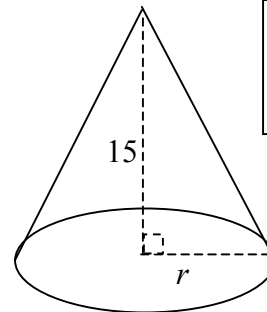
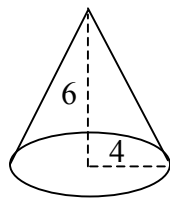


Note: Figure NOT drawn to scale

- What is the perimeter of triangle AFG ? Explain how you determined your answer. Use words, symbols, or both in your explanation.

39. In the figure below, the two cones are similar:

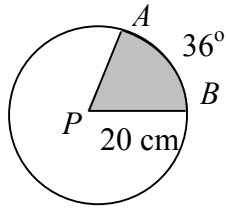
BCR



Note: Figures NOT drawn to scale

- What is the value of r ? Explain how you determined your answer. Use words, symbols, or both in your explanation.
- What is the ratio of the volumes of the cones? Use mathematics to justify your answer.

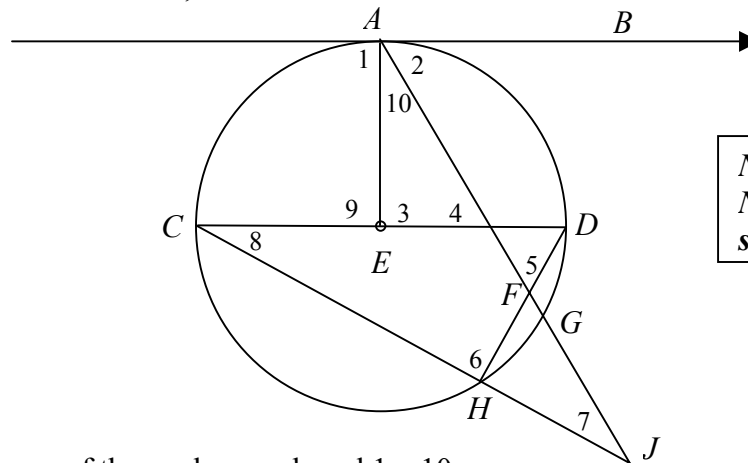
For problems 40 and 41, look at circle P below.



Note: Figure NOT drawn to scale

40. What is the length of \widehat{AB} ?
- A 4π B 8π C 80π D 160π
41. What is the area of the shaded sector?
- A 4π B 8π C 40π D 160π

42. In circle E below,
 \overline{AB} is tangent to the circle at A .
 $m\widehat{AD} = 90^\circ$ $m\widehat{DH} = 40^\circ$, $m\widehat{GH} = 30^\circ$

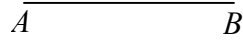


Note: Figure NOT drawn to scale

Find the measures of the angles numbered 1 – 10.

$m\angle 1 = \underline{\hspace{1cm}}$ $m\angle 2 = \underline{\hspace{1cm}}$ $m\angle 3 = \underline{\hspace{1cm}}$ $m\angle 4 = \underline{\hspace{1cm}}$ $m\angle 5 = \underline{\hspace{1cm}}$
 $m\angle 6 = \underline{\hspace{1cm}}$ $m\angle 7 = \underline{\hspace{1cm}}$ $m\angle 8 = \underline{\hspace{1cm}}$ $m\angle 9 = \underline{\hspace{1cm}}$ $m\angle 10 = \underline{\hspace{1cm}}$

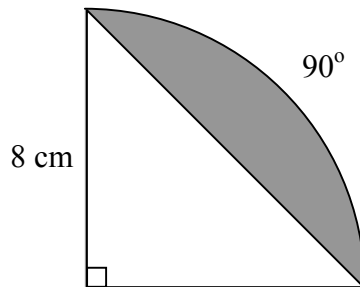
43. Describe the locus of all points in a plane that are one inch from \overline{AB} .



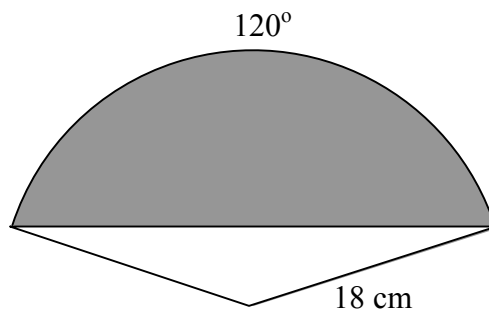
44. For a game, a spinner is in the shape of a circle with radius 10 cm. The spinner is divided into sectors. One sector intercepts an arc of 72 degrees. What is the area of that sector?

For problems 45-46, find the area of the shaded segments of the circles.

- 45.



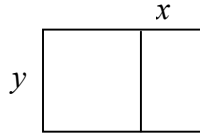
- 46.



47. If two polygons are similar, what is known about their angles and sides?

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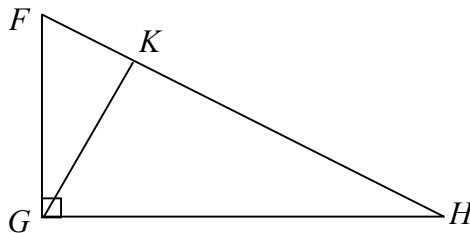
48. Look at the golden rectangle below.



Write a proportion involving x and y based on the golden rectangle.

49. Describe the set of points *in space* that are one inch from segment \overline{AB} .

For problems 50-52 below, $\triangle FGH$ is a right triangle, \overline{GK} an altitude.



50. Which of the following are similar to triangle $\triangle FGH$?

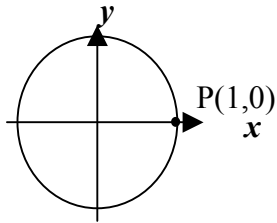
- I Triangle $\triangle FKG$
- II Triangle $\triangle GKH$

- A I only B II only C Both I and II D Neither I nor II

51. If $HK = 12$ and $FK = 3$, what is GK ?

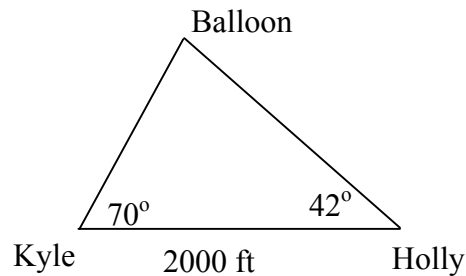
52. Write three proportions using GK .

For Problems 53 – 54 use the unit circle below.



53. What angle of rotation will transform point P to an image of $P'(0,1)$?
54. What is $\sin 270^\circ$?
55. Kyle and Holly are 2000 feet apart and both are looking at a balloon. At one time, Holly sees the hot-air balloon with an angle of elevation of 42° , while at the same time, Kyle sees the balloon with an angle of elevation of 70° .

ECR

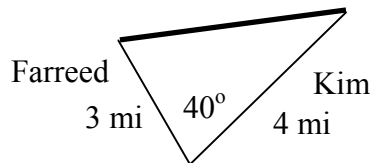


- How far are Holly and Kyle from the balloon? Explain how you determined your answer. Use words, symbols, or both in your answer.
- How high is the balloon? Explain how you determined your answer. Use words, symbols, or both in your answer.

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Farreed and Kim begin walking from the intersection of two roads. The angle between the roads is 40° , as shown in the figure below. Farreed walks 3 miles on one road, and Kim walks 4 miles on the other road.



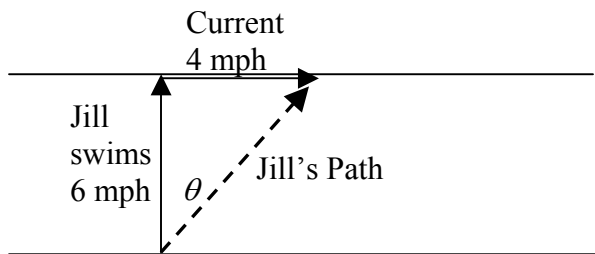
- What is the distance between Farreed and Kim? Explain how you determined your answer. Use words, symbols, or both in your answer.

57. Below are vectors \vec{u} and \vec{v} .



Sketch the resultant vector $\vec{u} + \vec{v}$ using both the head-to-tail and the parallelogram methods.

58. Jill can swim 6 miles per hour in still water. She tries to swim straight across a stream that has a current of 4 miles per hour. The dashed resultant vector is her path, shown in the drawing below.



- a. At what speed is Jill traveling?
 - b. At what angle, θ , is Jill swimming with respect to her intended path?
59. Plot and give the coordinates of all points that are 4 taxidistance units from $P(1,2)$.

