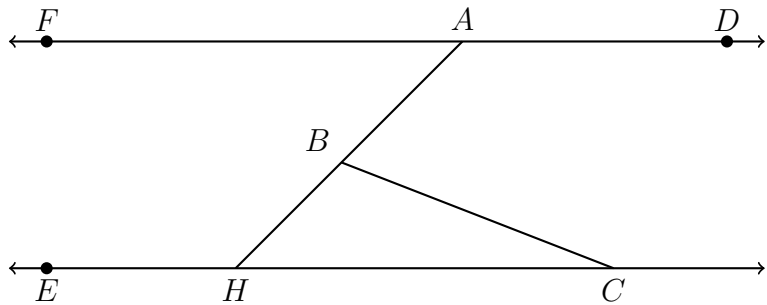


Angle calculation situations

1. In the diagram below, $\overline{FAD} \parallel \overline{EHC}$, and \overline{ABH} and \overline{BC} are drawn.

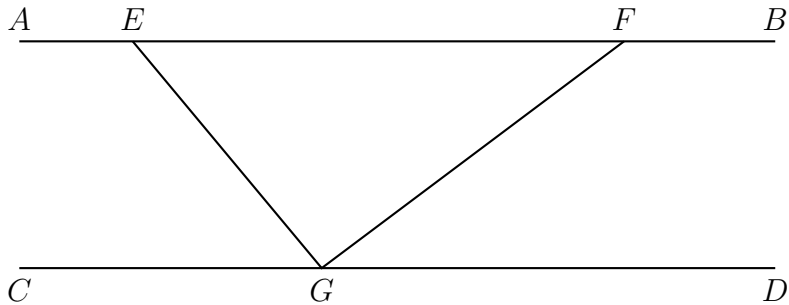


- If $m\angle FAB = 48^\circ$ and $m\angle ECB = 18^\circ$, what is $m\angle ABC$?
- (a) 18°

(b) 48°

(c) 66°

(d) 114°
2. In the diagram below, $\overline{AEFB} \parallel \overline{CGD}$, and \overline{GE} and \overline{GF} are drawn.

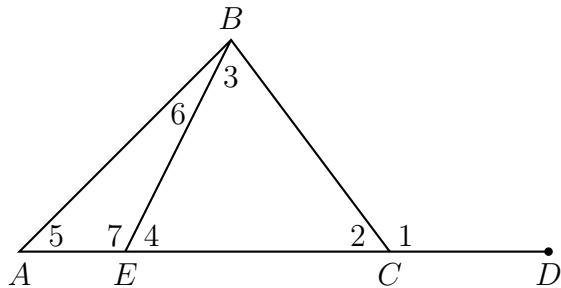


- If $m\angle EFG = 32^\circ$ and $m\angle AEG = 137^\circ$, what is $m\angle EGF$?
- (a) 11°

(b) 43°

(c) 75°

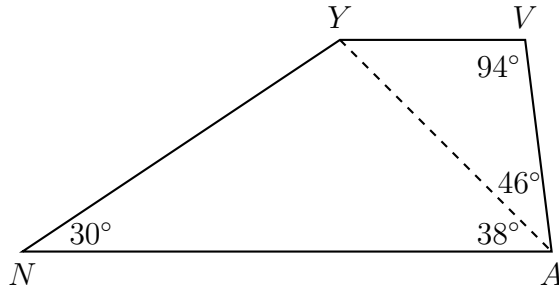
(d) 105°
3. In the diagram below of triangle ABC , \overline{AC} is extended through point C to point D , and \overline{BE} is drawn to \overline{AC} .



Which equation is always true?

- (a) $\angle 1 = m\angle 3 + m\angle 2$ (c) $\angle 6 = m\angle 3 - m\angle 2$
 (b) $\angle 5 = m\angle 3 - m\angle 2$ (d) $\angle 7 = m\angle 3 + m\angle 2$

4. In diagram of quadrilateral $NAVY$, $m\angle YNA = 30^\circ$, $m\angle YAN = 38^\circ$, $m\angle AVY = 94^\circ$, and $m\angle VAY = 46^\circ$.

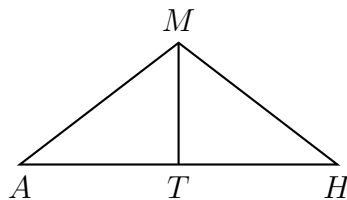


Which segment has the shortest length?

- (a) \overline{AY} (c) \overline{VA}
 (b) \overline{NY} (d) \overline{VY}

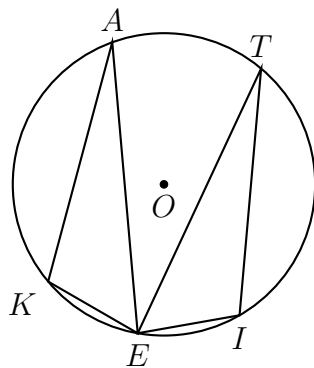
Congruence and similarity situations

5. Triangle $A'B'C'$ is the image of triangle ABC after a translation of 2 units to the right and 3 units up. Is triangle ABC congruent to triangle $A'B'C'$? Explain why.
6. In triangle MAH below, \overline{MT} is the perpendicular bisector of \overline{AH} .



Which statement is *not* always true?

- (a) $\triangle MAH$ is isosceles.
 (b) $\triangle MAT$ is isosceles.
 (c) \overline{MT} bisects $\angle AMH$.
 (d) $\angle A$ and $\angle TMH$ are complementary.
7. In the diagram below of circle O , points K , A , T , I , and E are on the circle, $\triangle KAE$ and $\triangle ITE$ are drawn, $\widehat{KE} \cong \widehat{EI}$, and $\angle EKA \cong \angle EIT$.



Which statement about $\triangle KAE$ and $\triangle ITE$ is always true?

- (a) They are neither congruent nor similar.
- (b) They are similar but not congruent.
- (c) They are right triangles.
- (d) They are congruent.

Linear equations

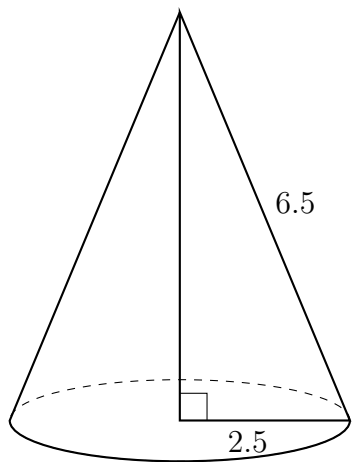
8. Determine and state an equation of the line perpendicular to the line $5x - 4y = 10$ and passing through the point $(5, 12)$.
9. What is an equation of the image of the line $y = \frac{3}{2}x - 4$ after a dilation of a scale factor of $\frac{3}{4}$ centered at the origin?
10. Which equation represents a line that is perpendicular to the line represented by $y = \frac{2}{3}x + 1$?
- (a) $3x + 2y = 12$ (c) $y = \frac{3}{2}x + 2$
- (b) $3x - 2y = 12$ (d) $y = -\frac{2}{3}x + 4$
11. What is an equation of the line that passes through the point $(6, 8)$ and is perpendicular to a line with equation $y = \frac{3}{2}x + 5$?
- (a) $y - 8 = \frac{3}{2}(x - 6)$ (c) $y + 8 = \frac{3}{2}(x + 6)$
- (b) $y - 8 = -\frac{3}{2}(x - 6)$ (d) $y + 8 = -\frac{3}{2}(x + 6)$
12. Line MN is dilated by a scale factor of 2 centered at the point $(0, 6)$. If \overline{MN} is represented by $y = -3x + 6$, which equation can represent $\overline{M'N'}$, the image of \overline{MN} ?
- (a) $y = -3x + 12$ (c) $y = -6x + 12$
- (b) $y = -3x + 6$ (d) $y = -6x + 6$
13. The line represented by $2y = x + 8$ is dilated by a scale factor of k centered at the origin, such that the image of the line has an equation of $y - \frac{1}{2}x = 2$. What is the scale factor?

Partition line segments by a given ratio

14. The endpoints of directed line segment PQ have coordinates of $P(-7, -5)$ and $Q(5, 3)$. What are the coordinates of point A , on \overline{PQ} , that divide \overline{PQ} into a ratio of 1:3?
15. Point M divides \overline{AB} so that $AM : MB = 1 : 2$. If A has coordinates $(-1, -3)$ and B has coordinates $(8, 9)$, what are the coordinates of M ?
16. The coordinates of the endpoints of directed line segment ABC are $A(-8, 7)$ and $C(7, -13)$. If $AB : BC = 3 : 2$, what are the coordinates of B ?
17. Directed line segment DE has endpoints $D(-4, -2)$ and $E(1, 8)$. Point F divides such that $DF : FE$ is 2 : 3. What are the coordinates of F ?

Volume, density

18. A cone has a volume of 108π and a base diameter of 12. What is the height of the cone?
19. A child's tent can be modeled as a pyramid with a square base whose sides measure 60 inches and whose height measures 84 inches. What is the volume of the tent, to the *nearest cubic foot*?
20. Lou has a solid clay brick in the shape of a rectangular prism with a length of 8 inches, a width of 3.5 inches, and a height of 2.25 inches. If the clay weighs 1.055 oz/in^3 , how much does Lou's brick weigh, to the nearest ounce?
21. A rectangular tabletop will be made of maple wood that weighs 43 pounds per cubic foot. The tabletop will have a length of eight feet, a width of three feet, and a thickness of one inch. Determine and state the weight of the tabletop, in pounds.
22. The base of a pyramid is a rectangle with a width of 4.6 cm and a length of 9 cm. What is the height, in centimeters, of the pyramid if its volume is 82.8 cm^3 ?
23. Randy's basketball is in the shape of a sphere with a maximum circumference of 29.5 inches. Determine and state the volume of the basketball, to the *nearest cubic inch*.
24. As shown in the diagram below, the radius of a cone is 2.5 cm and its slant height is 6.5 cm.



How many cubic centimeters are in the volume of the cone? Express your answer in terms of π .

3-D rotation

25. Which three-dimensional figure will result when a rectangle 6 inches long and 5 inches wide is continuously rotated about the longer side?
- (a) a rectangular prism with a length of 6 inches, width of 6 inches, and height of 5 inches
 - (b) a rectangular prism with a length of 6 inches, width of 5 inches, and height of 5 inches
 - (c) a cylinder with a radius of 5 inches and a height of 6 inches
 - (d) a cylinder with a radius of 6 inches and a height of 5 inches
26. An isosceles right triangle whose legs measure 6 is continuously rotated about one of its legs to form a three-dimensional object. The three-dimensional object is a
- (a) cylinder with a diameter of 6
 - (b) cylinder with a diameter of 12
 - (c) cone with a diameter of 6
 - (d) cone with a diameter of 12

Scale effects

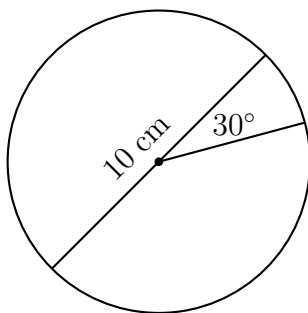
27. After a dilation with center $(0,0)$, the image of \overline{DB} is $\overline{D'B'}$. If $DB = 4.5$ and $D'B' = 18$, then what is the scale factor of this dilation?
28. Given square $RSTV$, where $RS = 9$ cm. If square $RSTV$ is dilated by a scale factor of 3 about a given center, what is the perimeter, in centimeters, of the image of $RSTV$ after the dilation?
29. Jaden is comparing two cones. The radius of the base of cone A is twice as large as the radius of the base of cone B. The height of cone B is twice the height of cone A. The volume of cone A is
- (a) twice the volume of cone B
 - (b) four times the volume of cone B
 - (c) equal to the volume of cone B
 - (d) equal to half the volume of cone B

Transformations (onto)

30. A regular hexagon is rotated about its center. Which degree measure will carry the regular hexagon onto itself?
- (a) 45° (c) 120°
 (b) 90° (d) 135°

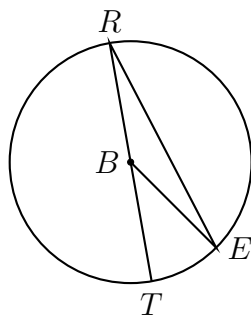
Sector area

31. The area of a sector of a circle with a radius measuring 15 cm is $75\pi \text{ cm}^2$. What is the measure of the central angle that forms the sector?
32. A circle with a diameter of 10 cm and a central angle of 30° is drawn below.



What is the area, to the *nearest tenth of a square centimeter*, of the sector formed by the 30° angle?

33. In circle B below, diameter \overline{RT} , radius \overline{BE} , and chord \overline{RE} are drawn.



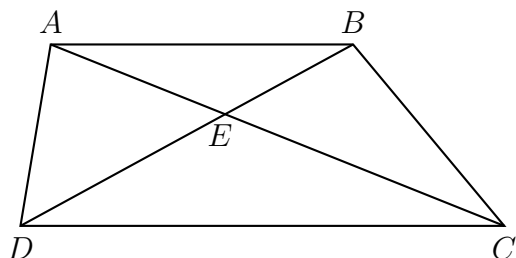
It $m\angle TRE = 15^\circ$ and $BE = 9$, then the area of sector EBR is what in terms of π ?

Similar triangles (dilation)

34. Triangle JGR is similar to triangle MST . Which statement is *not* always true?

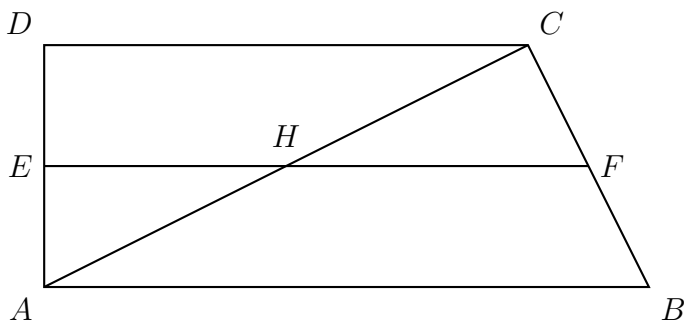
- (a) $\angle J \cong \angle M$ (c) $\angle R \cong \angle T$
 (b) $\angle G \cong \angle T$ (d) $\angle G \cong \angle S$

35. In trapezoid $ABCD$ below, $\overline{AB} \parallel \overline{CD}$.



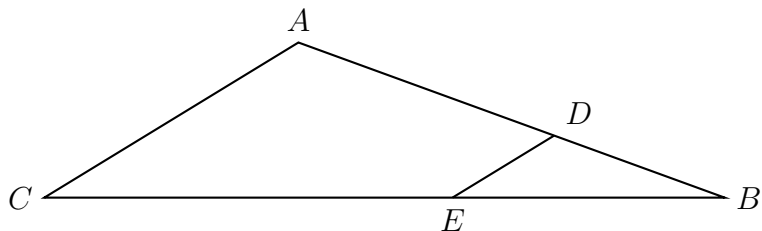
If $AE = 5.2$, $AC = 11.7$, and $CD = 10.5$, what is the length of \overline{AB} , to the nearest tenth?

36. In quadrilateral $ABCD$ below, $\overline{AB} \parallel \overline{CD}$, and E , H , and F are the midpoints of \overline{AD} , \overline{AC} , and \overline{BC} , respectively.



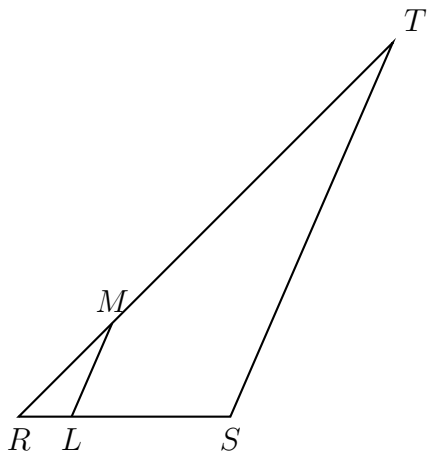
If $AB = 24$, $CD = 18$, and $AH = 10$, then what is FH ?

37. In the diagram of $\triangle ABC$ below, points D and E are on sides \overline{AB} and \overline{CB} respectively, such that $\overline{DE} \parallel \overline{AC}$.



If EB is 3 more than DB , $AB = 14$, and $CB = 21$, what is the length of \overline{AD} ?

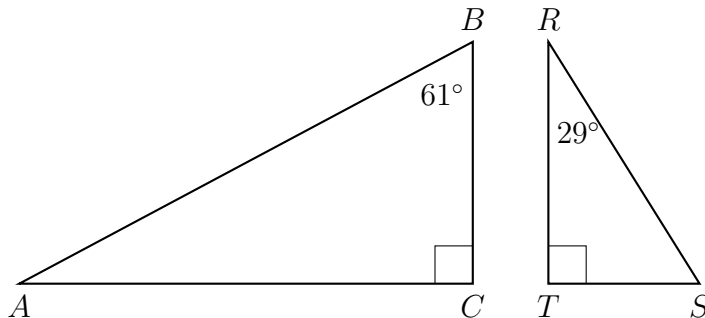
38. In the diagram below of $\triangle RST$, L is a point on \overline{RS} , and M is a point on \overline{RT} , such that $\overline{LM} \parallel \overline{ST}$.



If $RL = 2$, $LS = 6$, $LM = 4$, and $ST = x + 2$, what is the length of \overline{ST} ?

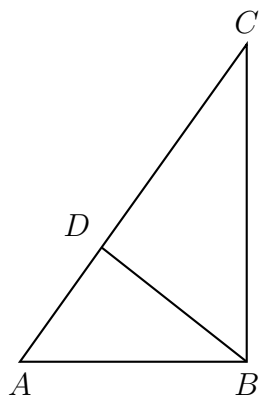
Similarity (altitude of a right triangle)

39. Given right triangle ABC with a right angle at C , $m\angle B = 61^\circ$. Given right triangle RST with a right angle at T , $m\angle R = 29^\circ$.



Which proportion in relation to $\triangle ABC$ and $\triangle RST$ is *not* correct?

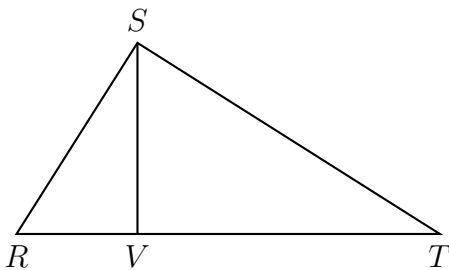
- (a) $\frac{AB}{RS} = \frac{RT}{AC}$ (c) $\frac{BC}{ST} = \frac{AC}{RT}$
 (b) $\frac{BC}{ST} = \frac{AB}{RS}$ (d) $\frac{AB}{AC} = \frac{RS}{RT}$
40. In the accompanying diagram of right triangle ABC , altitude \overline{BD} is drawn to hypotenuse \overline{AC} .



Which statement must be true?

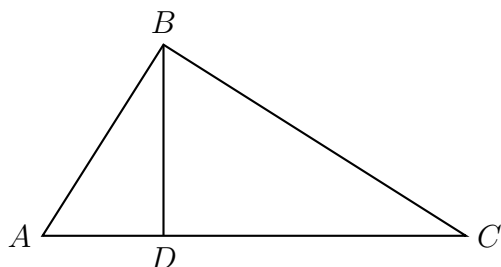
- (a) $\frac{AD}{AB} = \frac{BC}{AC}$ (c) $\frac{BD}{BC} = \frac{AB}{AD}$
 (b) $\frac{AD}{AB} = \frac{AB}{AC}$ (d) $\frac{AB}{BC} = \frac{BD}{AC}$

41. In right triangle RST below, altitude \overline{SV} is drawn to hypotenuse \overline{RT} .



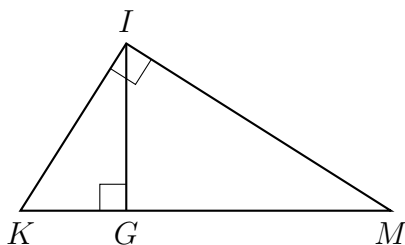
If $RV = 4.1$ and $TV = 10.2$, what is the length of \overline{ST} , to the *nearest tenth*?

42. In the diagram below of right triangle ABC , altitude \overline{BD} is drawn to hypotenuse \overline{AC} .



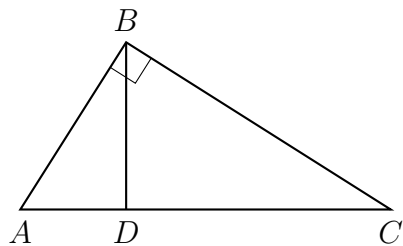
If $BD = 4$, $AD = x - 6$, and $CD = x$, what is the length of \overline{CD} ?

43. In the diagram below of right triangle KMI , altitude \overline{IG} is drawn to hypotenuse \overline{KM} .



If $KG = 9$ and $IG = 12$, what is the length of \overline{IM} ?

44. Line segment CD is the altitude drawn to hypotenuse in right triangle ECF . If $EC = 10$ and $EF = 24$, then, to the *nearest tenth*, ED is what length?
45. In diagram below of right triangle ABC , altitude \overline{BD} is drawn.



Which ratio is always equivalent to $\cos A$?

(a) $\frac{AB}{BC}$

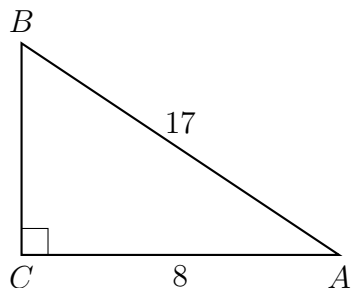
(c) $\frac{BD}{AB}$

(b) $\frac{BD}{BC}$

(d) $\frac{BC}{AC}$

Trigonometry

46. In the diagram below of right triangle ABC , $AC = 8$, and $AB = 17$.

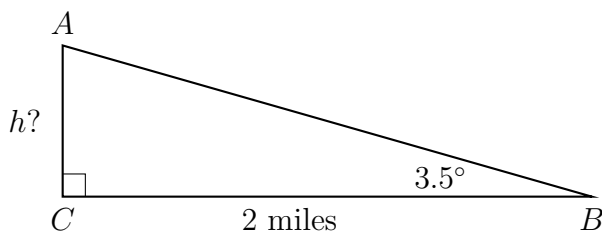


Which equation would determine the value of angle A ?

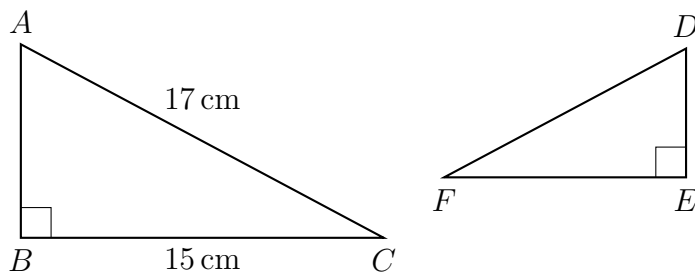
- (a) $\sin A = \frac{8}{17}$ (c) $\cos A = \frac{15}{17}$
(b) $\tan A = \frac{8}{15}$ (d) $\tan A = \frac{15}{8}$
47. From a point on the ground one-half mile from the base of a historic monument, the angle of elevation to its top is 11.87° . To the nearest foot, what is the height of the monument? (1 mile = 5280 feet)
48. At a distance of two miles, the angle of elevation to the top of a radio tower is 3.5° .

What is the height of the tower, to the *nearest foot*? (1 mile = 5280 feet)

not to scale

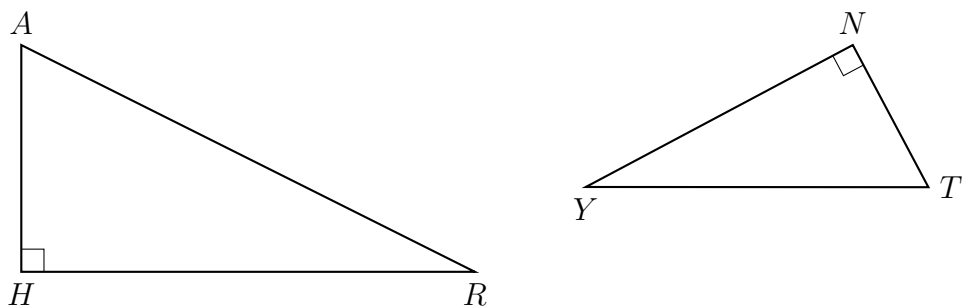


49. In right triangle ABC , hypotenuse \overline{AB} has a length of 26 cm, and side \overline{BC} has a length of 17.6 cm. What is the measure of angle B , to the *nearest degree*?
50. Kayla was cutting right triangles from wood to use for an art project. Two of the right triangles she cut are shown below.



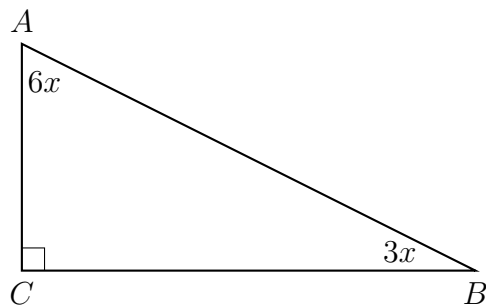
If $\triangle ABC \sim \triangle DEF$, with right angles B and E, $BC = 15$ cm, and $AC = 17$ cm, what is the measure of $\angle F$, to the *nearest degree*?

51. In the diagram below of $\triangle HAR$ and $\triangle NTY$, angles H and N are right angles, and $\triangle HAR \sim \triangle NTY$



If $AR = 13$ and $HR = 12$, what is the measure of $\angle Y$, to the *nearest degree*?

52. In the diagram below of right $\triangle ABC$, $\sin A = \cos B$, $m\angle A = 6x$, and $m\angle B = 3x$. Find x .



53. For the acute angles in a right triangle, $\sin(4x)^\circ = \cos(3x + 13)^\circ$.
What is the number of degrees in the measure of the smaller angle?
54. In a right triangle, the acute angles have the relationship $\sin(2x + 4) = \cos(46)$.
What is the value of x ?
55. In right triangle ABC , $m\angle C = 90^\circ$ and $AC \neq BC$. Which trigonometric ratio is equivalent to $\sin B$?

(a) $\cos A$

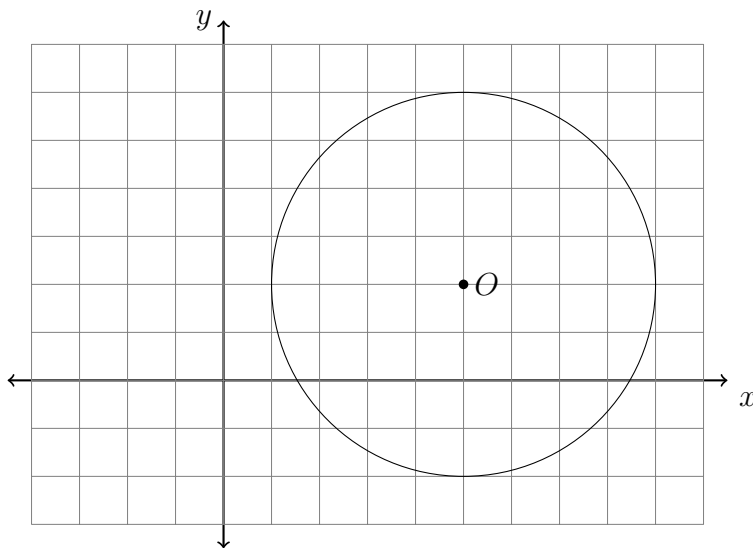
(c) $\tan A$

(b) $\cos B$

(d) $\tan B$

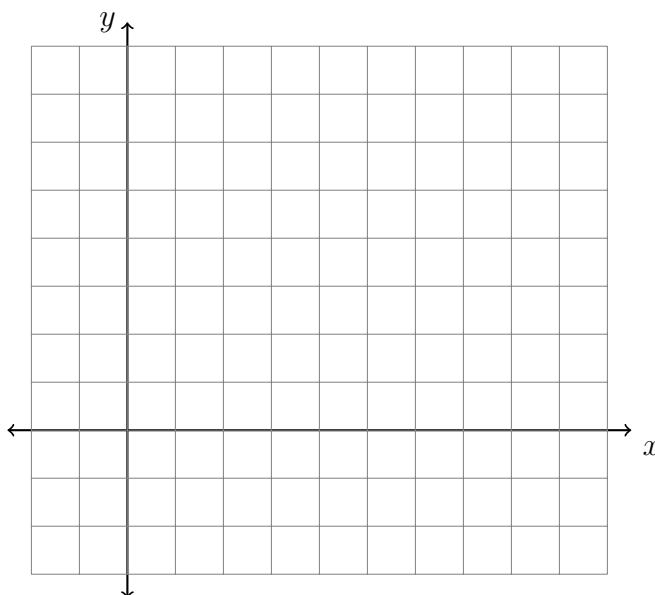
Circle equations

56. What is the equation of a circle with center $(5, 7)$ and radius $r = 3$?
57. What are the coordinates of the center and the length of the radius of the circle whose equation is $(x - 3)^2 + y^2 = 16$?
58. What is the equation of a circle with center $(-3, 7)$ and radius $r = 4$?
59. The equation of a circle is $x^2 + y^2 - 2x - 14y = -14$. What are the center and radius of the circle?
60. The equation of a circle is $x^2 + 8x + y^2 - 12y = 144$. What are the coordinates of the center and the length of the radius of the circle?
- (a) center $(4, -6)$ and radius 12
- (b) center $(-4, 6)$ and radius 12
- (c) center $(4, -6)$ and radius 14
- (d) center $(-4, 6)$ and radius 14
61. What is an equation of circle O shown in the graph below?



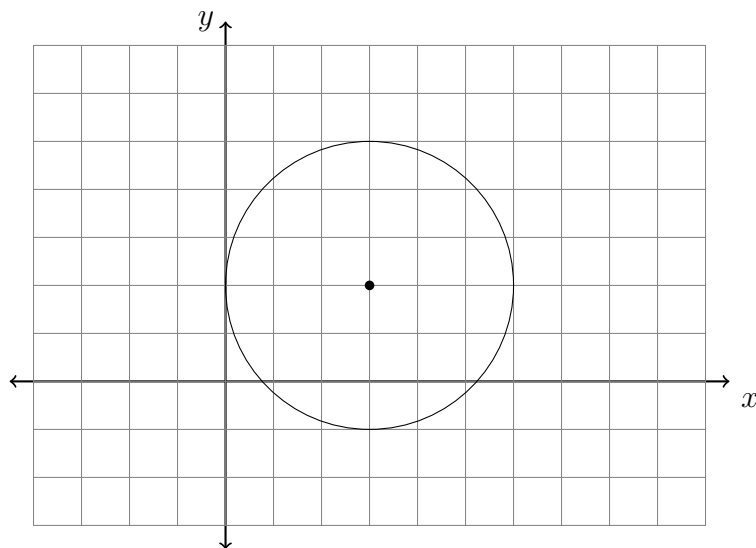
- (a) $x^2 + 10x + y^2 + 4y = -13$
- (b) $x^2 - 10x + y^2 - 4y = -13$
- (c) $x^2 + 10x + y^2 + 4y = -25$
- (d) $x^2 - 10x + y^2 - 4y = -25$

62. What are the coordinates of the center and the length of the radius of the circle whose equation is $x^2 + y^2 = 8x - 6y + 39$?
- (a) center $(-4, 3)$ and radius 64
 - (b) center $(4, -3)$ and radius 64
 - (c) center $(-4, 3)$ and radius 8
 - (d) center $(4, -3)$ and radius 8
63. What is an equation of a circle whose center is $(1, 4)$ and diameter is 10?
- (a) $x^2 - 2x + y^2 - 8y = 8$
 - (b) $x^2 + 2x + y^2 + 8y = 8$
 - (c) $x^2 - 2x + y^2 - 8y = 83$
 - (d) $x^2 + 2x + y^2 + 8y = 83$
64. The equation of a circle is $x^2 + y^2 + 4x - 8y = -16$. The statement that best describes circle O is the
- (a) center is $(2, -4)$ and is tangent to the x -axis
 - (b) center is $(2, -4)$ and is tangent to the y -axis
 - (c) center is $(-2, 4)$ and is tangent to the x -axis
 - (d) center is $(-2, 4)$ and is tangent to the y -axis
65. What is the equation of a circle whose diameter is \overline{AB} with $A(2, -1)$ and $B(8, 7)$?



66. What are the coordinates of the center and the length of the radius of the circle whose equation is $(x + 8)^2 + (y - 3)^2 = 4$?

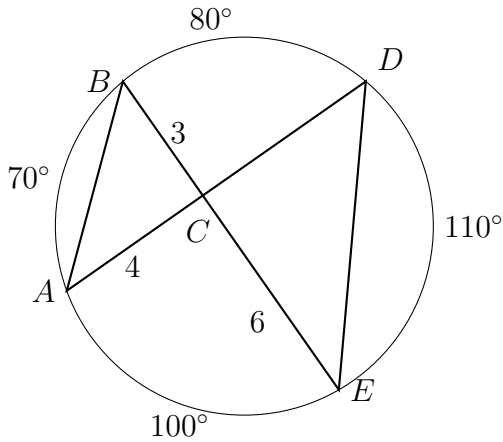
67. What is the equation of a circle with center $(1, -9)$ and radius $r = 8$?
68. What is an equation of circle O shown in the graph below?



69. The equation of a circle is $x^2 + y^2 - 6x + 2y = 6$. What are the coordinates of the center and the length of the radius of the circle?
- (a) center $(-3, 1)$ and radius 4
 - (b) center $(3, -1)$ and radius 4
 - (c) center $(-3, 1)$ and radius 16
 - (d) center $(3, -1)$ and radius 16

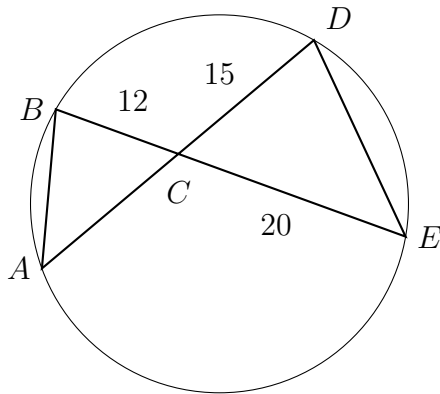
Chord and sector situations (Similarity)

70. As shown, circle O has chords \overline{AD} and \overline{BE} intersecting at C , and $m\widehat{AB} = 70^\circ$, $m\widehat{BD} = 80^\circ$, $m\widehat{AE} = 100^\circ$, and $m\widehat{DE} = 110^\circ$. $BC = 3$, $AC = 4$, and $CE = 6$.

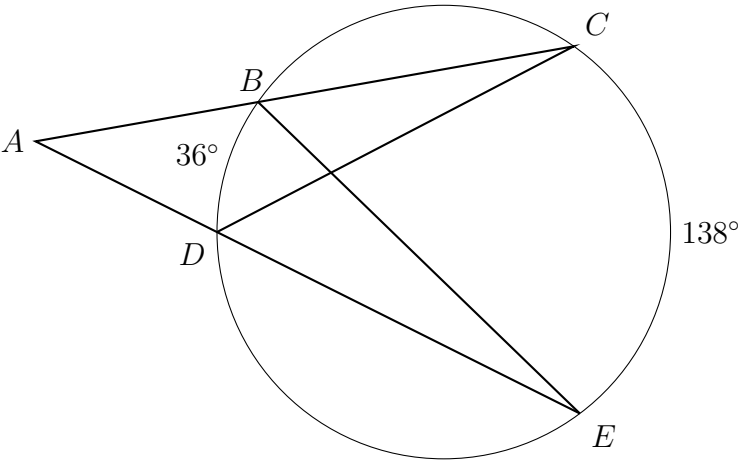


- Write down the measure of angles $\angle B$ and $\angle D$.
- Write down the measure of angles $\angle A$ and $\angle E$.
- Find the measures of the two angles at C .
- Find the scale factor and CD .

71. Circle O has chords \overline{AD} and \overline{BE} intersecting at C , as shown. Find AC .

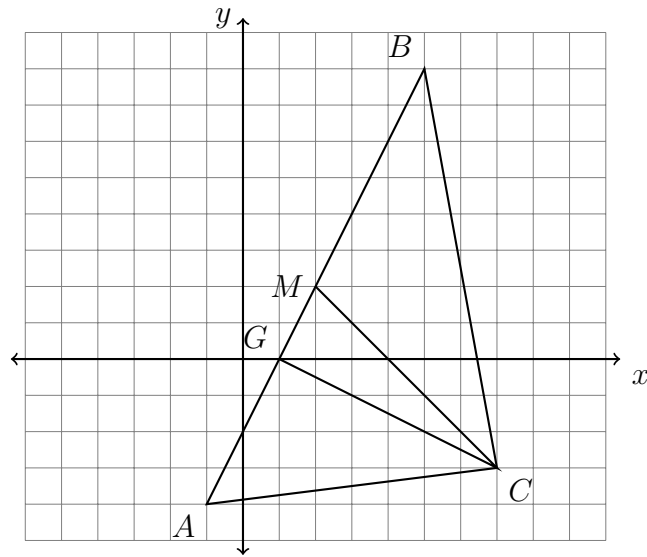


72. The secants \overline{ABC} and \overline{ADE} intersect the circle O , as shown in the diagram. Given $m\widehat{BD} = 36^\circ$ and $m\widehat{CE} = 138^\circ$.
- Find the $m\angle CDE$, $m\angle CBE$.
 - Find the $m\angle C$, $m\angle E$.
 - Find the $m\angle A$.
 - Two similar triangles are shown. Write a similarity statement, listing the triangles' vertices in corresponding order.



Analytic geometry

73. In the diagram below, $\triangle ABC$, altitude \overline{CG} , and median \overline{CM} are drawn.



Which expression represents the area of $\triangle ABC$?

- (a) $\frac{(BC)(AC)}{2}$

(b) $\frac{(GC)(BC)}{2}$
- (c) $\frac{(CM)(AB)}{2}$

(d) $\frac{(GC)(AB)}{2}$