Algebra Samples

1. The expression *n*! is called a *factorial*. It is defined this way:
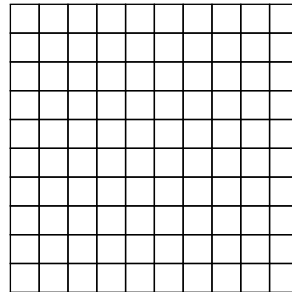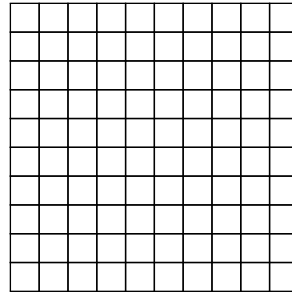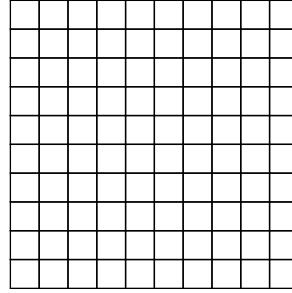
$$n! = n(n - 1)(n - 2) \cdots (3)(2)(1)$$

So, for example:
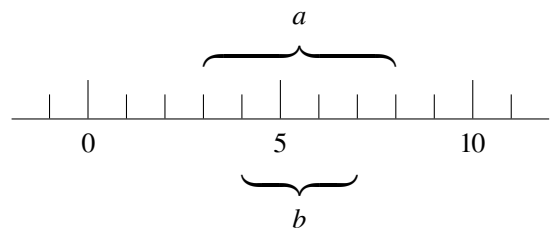
$$5! = (5)(4)(3)(2)(1) = 120$$

Given that definition, 15! is divisible by which of the following?

○ 16

○ 17

○ 49

○ 77

2. How many factors of 2 are there in
$20 \times 19 \times 18 \times \cdots \times 3 \times 2 \times 1$?

3. Draw three different representations of 70% on the graphs.

4. Find the value of $b^a - a^b$.

5. A bacteria was put in a petrie dish to grow and reproduced at the rate shown. How many bacteria will there be in the dish after six hours?

	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours
Number of germs	2	3	5	8	13	x

6. During track and field practice, each person does the long jump. Mario's average distance is $81p$ inches.

   a) Write an expression for his average distance in *yards*.

   b) What expression represents the distance in *feet*?

7. Jeff is 5 inches taller than Teresa, but 4 inches shorter than Mary. If their combined heights total 194 inches, how tall is Jeff? One way to solve this problem is:

   Let Jeff's height $= x$.
   Then $x + (x + 4) + (x - 5) = 194$.
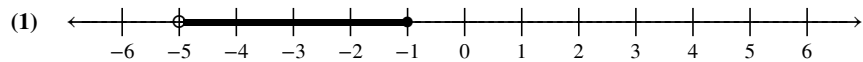
   What is another way to solve this problem?

8. Consider the following table and the information given in it:

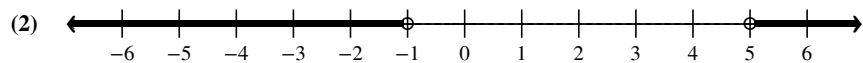|	RATE	TIME	DISTANCE
with	$R + C$	3	$3(R + C)$
against	$R - C$	4	$4(R - C)$

   Make up a word problem/situation that the above information could be used for.

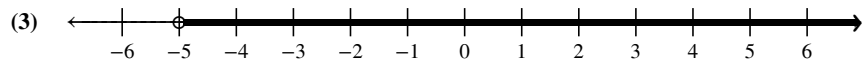9. Match each inequality on the left with the corresponding graph on the right.
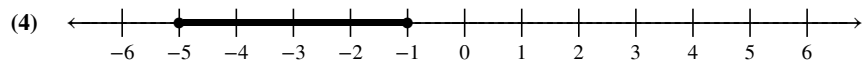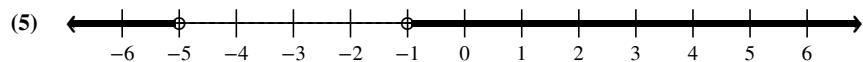
   (A) $-5 < x \le -1$ (1)

   (B) $-5 \le x \le -1$ (2)

   (C) $x \ge -5$ and $x \le -1$ (3)

   (D) $x < -1$ or $x > 5$ (4)

   (E) $|x + 3| \ge 2$ (5)

10. The stock market can be highly volatile. In one week, the market closed up 22 points, down $3\frac{1}{2}$ points, down $18\frac{1}{4}$ points, up 11 points, and up $5\frac{3}{4}$ points. What was the average close during that week?

11. Mrs. Kim is a real estate broker. Her salary is $1650 per month, plus 0.25% of sales. To earn $4000 in a month, how much does she need to sell?

12. Scott has grades of 86, 75, 79, and 95. If all of the grades count the same, what is the lowest grade he can make on the next test to have an average of 85?

13. Clinton has a $320 credit to spend from a raffle drawing but must choose only ONE type of item from the following list, even though he can have as many of that item as he can afford:

| Item	Price ea.
Knife Set	$115
Jewelry Chest	$79
Audio Rack	$63
Ice Cream Maker	$39

Clinton chooses the one which allows him to spend the greatest amount of his credit. How much of his credit does he have left after making that choice?

14. Which of the following statements are equivalent to the ratio $1 : 200$?

   ○ 2 days to 1 year

   ○ 5 grams to 1 kilogram

   ○ 1 nickel to 10 dollars

   ○ 20,000 centimeters to 2 kilometers

   ○ 888 centimeters to 8 millimeters

15. A engine's efficiency decreases steadily as it gets hotter. At $500°$, the engine has an efficiency rating of 0.08 and at $600°$, its rating is 0.07. What would you expect its efficiency rating to be at $1000°$?

16. What is the *total* length of all the edges in the figure shown?
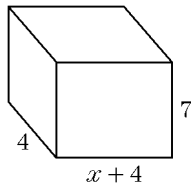
17. When a heavy object is suspended by a metal wire, the wire stretches a little bit. The amount of stretching can be approximated by the formula:

$$s = \frac{4w\ell}{\pi d^2 E},$$

where w is the weight of the object, ℓ is the original length of wire, d is the diameter of the wire, and E is a coefficient which depends on the type of metal. Find out how much 10 inches of steel wire will stretch if it is holding up 75 pounds, its diameter is 0.03 in., and $E = 1.5 \times 10^7$.

18. The top of Chicago's tallest building (which used to be called the Sears Tower) is more than a quarter mile above the ground. If the building is 1454 feet tall, how much more than a quarter mile is this?

19.
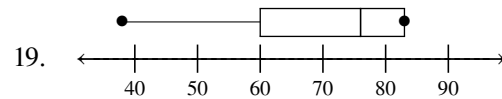
Under what conditions would a set of data yield this box-and-whisker plot?

20. Find the number of possible outcomes if you toss 2 dice simultaneously? Is this any different than tossing the same die twice?

21. Five times the sum of a number and 12 is 32 less than four times the number. What is that number?

22. Find four consecutive odd integers such that twice the second, added to the last, is 61.

23. Explain why three odd integers can never have an even sum.

24. In a western film, the desparado sits at a poker table with a stack of coins worth $50. There are as many silver dollars as there are quarters. Figure out the *total* number of coins.

25. Ms. Reid is eighteen years older than her son. One year ago, she was three times older than he was. How old is each person now?

26. How many minutes will it take a helicopter, flying at 120 km/hr, to reach a naval vessel that is 45 km away, if the vessel is heading toward the helicopter at 30 km/hr?

27. Reformate is used to boost the octane rating of gasoline. Assume there are two kinds of gasoline, which contain 20% and 12% reformate. How much of each should be mixed together to produce 3000 gallons of gasoline that is 18% reformate?

28. A wall covering compound is made up of water and plaster-of-paris. How many kilograms of water must be added to 7 kilograms of the compound, in order to reduce the concentration of plaster from 45% to 35%?

29. Joanna Kim invested $20,000 in two stock portfolios. With one portolio, she made a 12% profit; with the other, she had an 4% loss. Her net profit for the year was $1200. How much did she invest in the profitable stocks?

30. One side of a triangle is two-thirds as long as each of the other two sides. If the perimeter is 120, how long is each side?

31. Mrs. Hanson's 1st period class set up chairs for an assembly in 25 minutes. The next day her 2nd period class did the same job in 15 minutes. How long would it have taken the two classes, working together, to set up the chairs?

32. For which integral value of k can $kx^2 + 17x + k$ be expressed as the product of two binomials whose coefficients are integers?

33. Find a quadratic equation with integer coefficients whose roots are the reciprocals of the roots of $4x^2 - 23x + 15 = 0$.

34. The two angles are complementary. If $a = x^2 + 6x$ and $b = 10x + 10$, solve for x and find the measure of each angle.
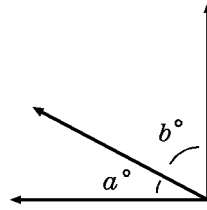
35. Find four consecutive integers such that the product of the first and fourth is 2 less than product of the middle integers.

36. The length of a rectangle is 5 cm less than twice the width. Find the length and width if the area is 88 sq cm.

37. A rectangular parking lot is 60 feet long and 45 feet wide. Its area is doubled when a strip of uniform width is added to all four sides. How wide is the strip?

38. A woman jumps off a diving board into a swimming pool. Her height is h feet above the board after t seconds, as given by the formula $h = 32t - 16t^2$.

    a) At what time is the woman 8 feet above the diving board?

    b) At what time is she 4 feet *below* the diving board?

   c) Can you figure out how long the woman is in the air? Explain.
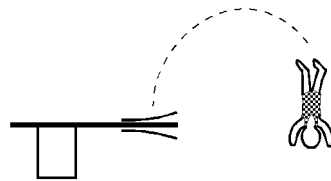
39. Separate 40 into two parts so that 3/5 of the larger part added to 1/2 of the smaller part is 29.

40. Assume there is a linear relationship between the cost of building a house and its size (the number of square feet of living space). If a 1700 sq ft house costs \$60,000 to build, and a 2300 sq ft house costs \$75,000, write an equation that relates cost to the square footage. Then graph the equation and determine the cost of building a 2500 sq ft house.

41. In Santa Fe, an Indian Cultural Center makes woven blankets and shirts. Each blanket requires 24 hours for spinning the yarn, 4 hours for dyeing, and 15 hours for weaving. Shirts require 12 hours for spinning, 3 hours for dyeing, and 9 hours for weaving. There are 216, 44, and 147 hours available for spinning, dyeing, and weaving respectively. The cost to make each blanket is \$73 and its selling price is \$105. The cost to make each shirt is \$29 and its selling price is \$47. How many of each item should be made to maximize profit? What is the maximum profit?

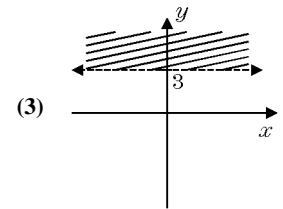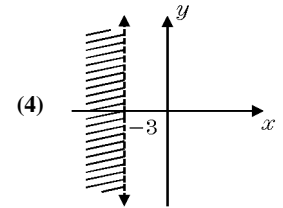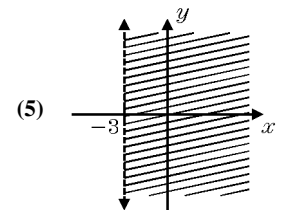42. Match each inequality with its corresponding graph.

(A) $x < -3$ (1)

(B) $y < 3$ (2)

(C) $x > -3$ (3)

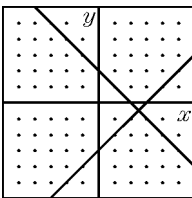(D) $y > -3$ (4)

(E) $y > 3$ (5)
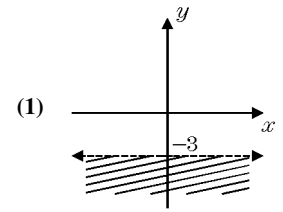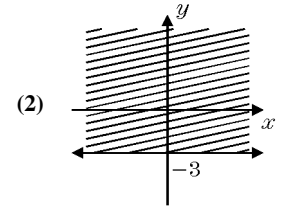
43. Refer to the graph of the system of linear equations. Use it to graph this system of inequalities:

$$x - y < 3$$
$$x + y \geq 2$$

Select the ordered pairs which are solutions of the system.

○ $(-5, 0)$

○ $(-1, 3)$

○ $(5, 0)$

○ $(5, -5)$

44. Below are four correspondences. Which of the correspondences could be written as a function?

○ the sixth grade teachers at a school
the ages of students in sixth grade

○ passengers on an airplane
the passengers' seat numbers

○ number of apples on a tree
price of apples in nearby stores

○ the length of a road
number of divider stripes on the road

45. Assume there is a linear relationship between the cost of a long distance phone call and the number of minutes of the call. It is known that a 10 minute call costs $4.50 and a 15 minute call costs $6.00.

   a) Determine the "per minute" charge and the flat charge for each long distance call.

   b) Write a linear equation that relates cost to the number of minutes of usage.

   c) Graph the equation and determine the cost of a 40 minute long distance call.

46. a) Create 5 ordered pairs for the equation: $y = 2x - 2$. Graph the equation.

x	$2x - 2$	y
2		
1		
0		
−1		
−2		

   b) Create 5 ordered pairs for the equation $y = 5x - 2$. Graph the equation.

x	$5x - 2$	y
2		
1		
0		
−1		
−2		

   c) Using the work from parts a and b, write a generalization about lines and their slopes.

47. How is the graph $y = \frac{1}{3}(x + 2)^2$ related to the graph of $y = x^2$?

○ horizontal expansion by a factor of 3

○ horizontal compression by a factor of 3

○ translation of 2 units left

○ translation of 2 units right

Algebra Samples

48. A survival kit is dropped from a helicopter. The height, h meters, of the kit above the ground t seconds after it is released is modelled by the quadratic function $h(t) = 235 - 4.9t^2$. How high is the survival kit above the ground after 5 s?

49. There is a number such that when you add it to twice its square the sum is minimized. What is this minimum sum?

50. A Norman window, which has a rectangular base and a semicircular top, has a perimeter of 50 feet. Let r be the radius of the semi-circle. Derive a function $A(r)$ that represents the area of the window and find the value of r for which the area of the window will be maximum. What is the maximum area?

Algebra Samples

Geometry Samples

1. Do the following as separate drawings. Use a protractor.

   a) Draw angle *JKL* measuring 100° and adjacent angle *JKM* measuring 80°.

   b) Draw complementary angles *XYW* and *WYZ*, where $m\angle WYZ = 25$.

   c) Draw vertical angles *ABC* and *XBY*, where $m\angle ABC = 170$.

   d) Draw two adjacent right angles $\angle LMN$ and $\angle NMO$.

2. In the diagram, $m\angle EOD = a + 4$, $m\angle DOB = 8a + 9$, and $m\angle COB = 3a + 5$. Express $m\angle EOC$ in terms of a.
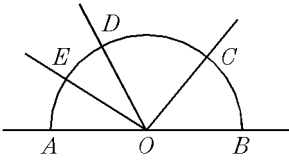
3. In the diagram, if ℓ_1 and ℓ_2 are parallel, which of the following must be true?

   ○ $\angle 2 \cong \angle 8$

   ○ $\angle 1 \cong \angle 8$

   ○ $\angle 2 \cong \angle 3$

   ○ $\angle 1 \cong \angle 5$

   ○ $\angle 3 \cong \angle 5$
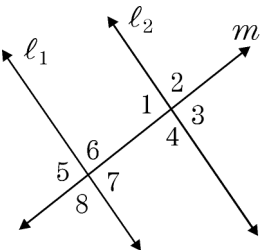
4. Two lines are cut by a transversal. Which of the following angle pairs, if congruent, could be used to show that the two lines are parallel?

   ○ corresponding

   ○ alternate interior

   ○ consecutive interior

   ○ alternate exterior

   ○ consecutive exterior

5. In the figure, *A*, *B*, *C*, and *D* are collinear. Which of the following statements are true?

   ○ $m\angle ABE = m\angle DCE$

   ○ $\triangle BEC$ is equiangular

   ○ $\triangle BEC$ is obtuse

   ○ $\angle E$ is right
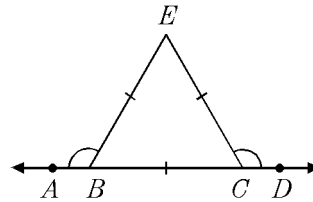
6. In the diagram, $m\angle 1 = 25$ and $m\angle 2 = 30$. What are the measures of $\angle 3$ and $\angle 4$?
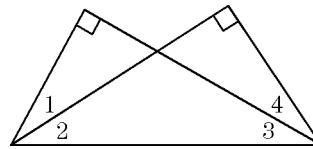

7. In isosceles $\triangle ABC$, the measure of $\angle B$ is 92°. Name the sides that are legs of this triangle *and* the measure of the base angles.

8. A triangle has two sides of length k and $k - 5$. The third side of this triangle must be shorter than _____, and longer than _____.

9. A trapezoid has bases of length $4x$ and x. The length of its median is 10. What are the lengths of the bases of this trapezoid?

10. Given $\square WXYZ$ with $m\angle W = 4n + 5$ and $m\angle Y = 3n + 21$. What is the measure of $\angle W$?

11. In the rectangle $RSTU$, diagonals $\overline{RT}$ and $\overline{US}$ intersect at point V. If $RV = 5x - 7$ and $TV = 2x + 5$, then find the length of $\overline{SU}$.
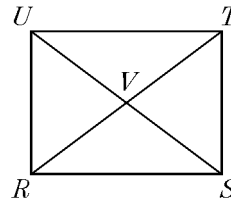

12. Complete the table. Determine how many diagonals can be drawn from a *single vertex* of each of the convex polygons. Then tell the number of triangles formed by these diagonals, and the total number of degrees in the triangles.

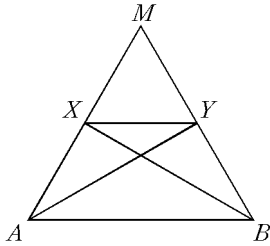| convex polygon	sides	diagonals	triangles	total degrees
triangle				
pentagon				
nonagon				
decagon				
n-gon				

13. In the diagram, $\triangle ABC \sim \triangle EFG$, $AB = 1 - x$, $AC = x + 4$, $EF = x^2 - 2x + 1$, and $EG = 4 - 3x - x^2$. What is the value of x?
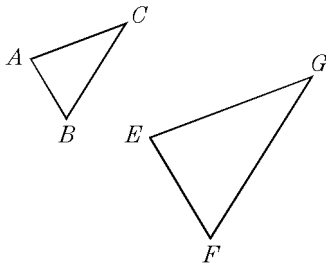

14. In the diagram, $\overline{BD}$ is the angle bisector of $\angle ABC$. $AB = 14$, $BC = 18$ and $DC = 6$. What is the length of $\overline{AD}$?
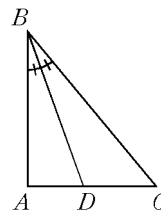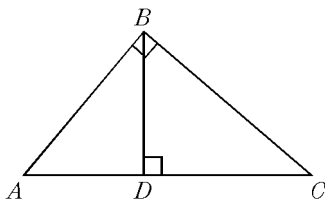
15. In the diagram, points X and Y are the midpoints of the legs of isosceles triangle ABM. What 2 triangles can be shown to be congruent with only the given information using SAS?

19. In the diagram, $AB = 7$, $BC = 15$, and $DC = 8$. Find AD.

20. A traffic light is suspended between two poles, as shown in the figure. The poles are 38 ft apart and 25 ft tall. If 40 ft of wire is used to suspend the light, approximately how far above the street is it?

16. In the diagram, $\triangle HJM \cong \triangle KJM$ and $\triangle HMP \cong \triangle KMP$. Can it be shown that that $\angle 1 \cong \angle 2$? How?
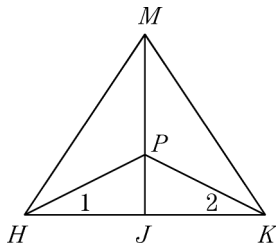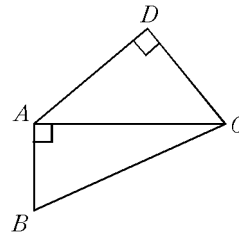
17. In the diagram, $BD = 5x$, $AD = 4x - \frac{1}{5}$, and $DC = 6x$. Find the value of x.

21. A stage is set according to the following specifications. A chair is placed at point A, a table at point B and the lamp at point C. If the distance from A to B is 8 feet and the distance from A to C is 7 feet, what is the distance from the table (point B) to the lamp (point C).
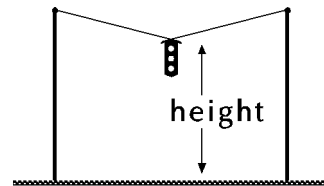
18. In a right triangle, one leg is longer than the other leg by a factor of $\sqrt{3}$. If the longer leg is 8 units long, what is the perimeter of the triangle?
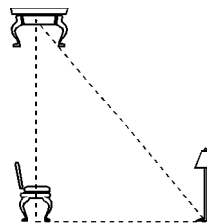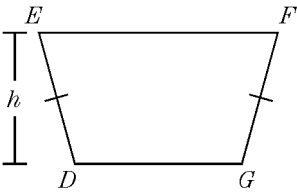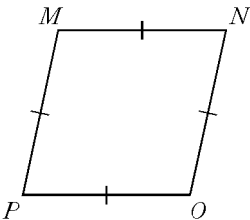
Geometry Samples

22. In the diagram, isosceles trapezoid *DEFG* has leg lengths $DE = FG = 15$, $h = 10$, and a perimeter of 80. What is the area of the trapezoid?


23. In the diagram, rhombus *MNOP* has diagonals $PN = 2 \cdot MO$ and the area of the rhombus is 400 units^2. What are the lengths of $\overline{PN}$ and $\overline{MO}$?

24. The shaded region in the diagram was formed by inscribing a square in equilateral $\triangle ABC$ the length of whose sides is 8 in. Find the area of the inscribed square to the nearest tenth of a square inch.
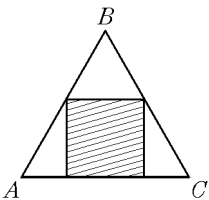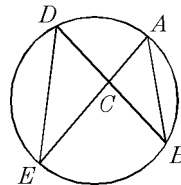

25. In circle *C*, $\overline{AB}$ and $\overline{PQ}$ are diameters, $m\angle BCP = 52$, and $m\angle ACR = 93$. Find the following measures.
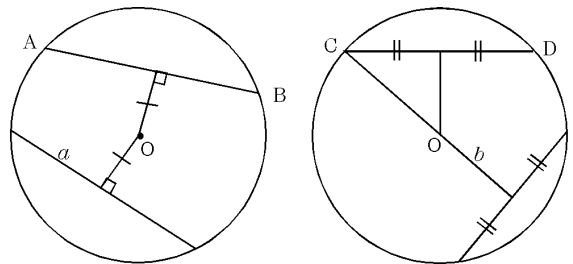

   a) $m\angle ACQ$

   b) $m\angle BCQ$

   c) $m\angle RCP$

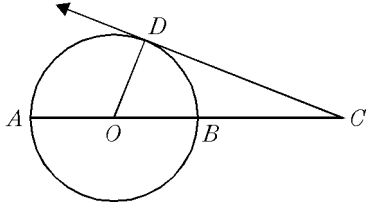   d) $m\widehat{AQ}$
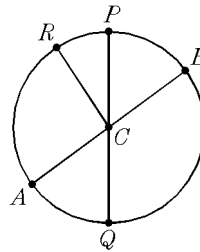
   e) $m\widehat{ABR}$

26. In the diagram, two chords of a circle intersect. Name an angle that must be congruent to $\angle AED$ and explain why it is congruent.
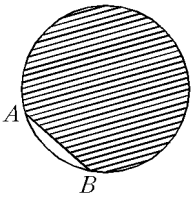

27. If equal chords are equidistant from the center of a circle, find *a* and *b* with $AB = 8$, $CD = 20$, and $CO = 12$.

28. In the diagram, $\overrightarrow{CD}$ is tangent to $\bigcirc O$ at point D. If $AB = 16$, $DC = 15$, what is the length of $\overline{BC}$?

29. In the diagram, $r = 8$, $m\overset{\frown}{AB} = 60$. Find the exact area of the shaded region.

30. A box shaped like a rectangular prism is used to hold dominoes. Each domino measures $6\,cm$ long by $3\,cm$ wide by $1.5\,cm$ high. If the box measures $36\,cm$ long by $30\,cm$ wide by $15\,cm$ high, how many dominoes will fit into the box?

31. A triangular right prism is shown. If $AB = BC = 13$, $AC = 24$, and $CF = BE = AD = 30$, what is the surface area of the prism?
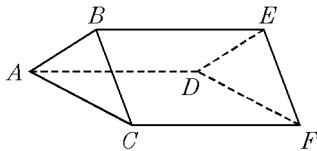
32. In the diagram, a cylindrical cake with a height of 5 inches has a $30°$ slice removed. If the volume of the removed slice is $40\,in^3$, what is the approximate radius of the cake?
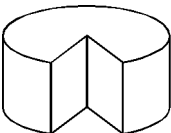
33. A bowl that is hemispheric in shape is filled with porridge to a depth of 3 inches. If the diameter of the bowl is 8 inches, what is the surface area of the porridge that is in the bowl?

34. $M(0, -1)$ is the midpoint between $A(-4, 4)$ and another point B. Calculate the coordinates of B and plot it on the graph.
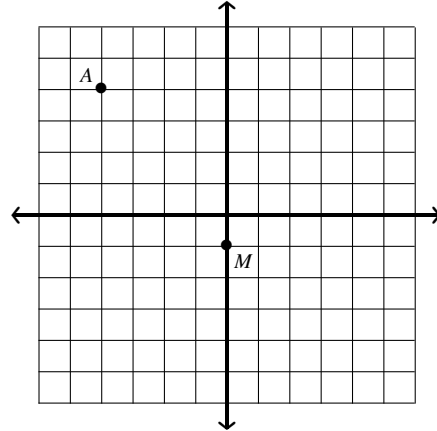
35. Which point, A, B, or C, is closest to point X?
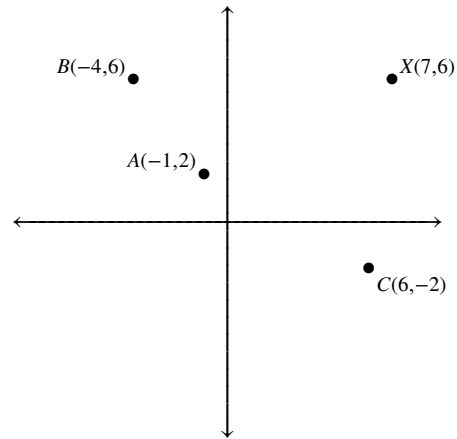
36. For what value of a are the points $(-1, -5)$, $(-3, -8)$, and $(a, 2a)$ collinear?

37. What happens to the slope of the line shown if the *x*-intercept is changed to 6 and the *y*-intercept remains the same?

38. A map's numerical coordinates are in kilometers. The town of Darmody is at $(3.4, 5.2)$ and Mortlach is at $(15.2, 1.8)$. A road is to be constructed on a direct line joining Darmody and Mortlach. Each community is responsible for the cost of the construction of the road to the midpoin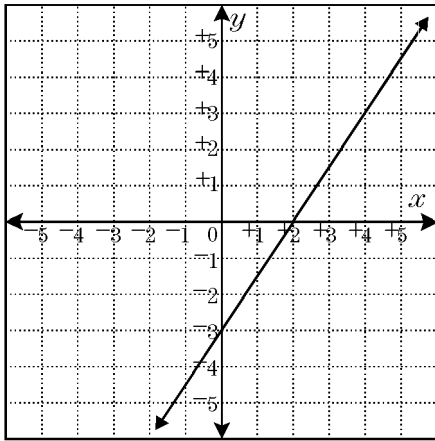t. The cost for construction is $\$24\,000$ per kilometer. Determine the cost of the construction, to the nearest thousand dollars, for Mortlach.

39. The coordinates of quadrilateral *ABCD* are $A(0, 2)$, $B(2, 6)$, $C(6, 4)$, and $D(4, 0)$. Determine if *ABCD* is a special quadrilateral. If so, justify your answer by noting appropriate and *sufficient* measurements.

40. Apply a glide reflection to $\triangle ABC$ that involves a translation $T: (x, y) \rightarrow (x - 1, y - 2)$ and a reflection in the *y*-axis. Label the vertices of the new triangle A', B', and C' and indicate their coordinates.
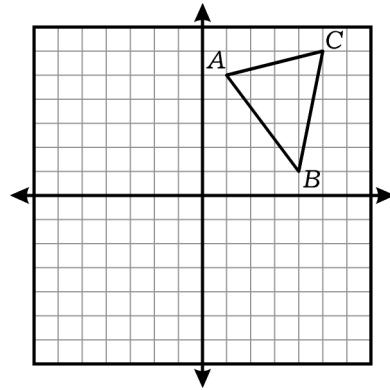
41. Using the given lengths *b* and *s*, construct and label an isosceles triangle with base *b* and congruent sides *s*.

$$\overline{\qquad b \qquad}$$

$$\overline{\qquad\qquad s \qquad\qquad}$$
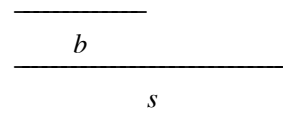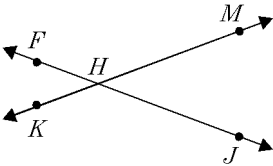
42. If $a > b$, then which inequalities must be true?

○ $a - b < 0$

○ $\frac{1}{3}a > \frac{1}{3}b$

○ $a^2 > b^2$

○ $a + 1 > b + 1$

○ $ab > 0$

43. Given: $\overline{PS} \perp \overline{SR}$,
    $\overline{SR} \perp \overline{RT}$,
    $\angle SPR$ is comple-
    mentary to
    $\angle RST$,
    $\angle RTS$ is comple-
    mentary to
    $\angle SRP$
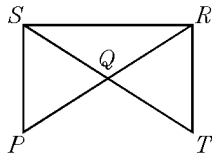
    Prove: $\angle PSQ \cong \angle TRQ$

44. Prove that $\angle FHJ$ is congruent to $\angle KHM$ in the diagram.

45. Prove the following theorem.

    If two lines are cut by a transversal and one pair of alternate interior angles are congruent, then the other pair of alternate interior angles are congruent.

46. Given: $\angle GMH$ and $\angle GKH$ are right angles, $\overline{GK} \cong \overline{GM}$
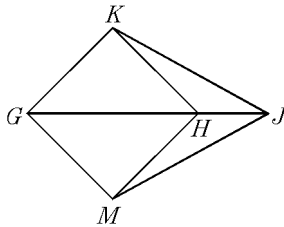
    Prove: $\overline{KJ} \cong \overline{MJ}$

47. The altitude to the hypotenuse of a right triangle divides the triangle into two smaller triangles. Prove the two smaller triangles are similar.

48. Give a complete proof for the following statement. (Be sure to state precisely what is given and what is to be proved.)

    The line joining the midpoints of the bases of an isosceles trapezoid is the perpendicular bisector of the longer base.
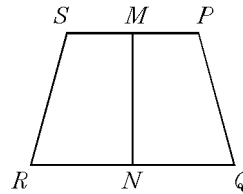
49. In circle O, $m\overset{\frown}{CD} > m\overset{\frown}{AB}$. Prove that $m\angle COD > m\angle AOB$.
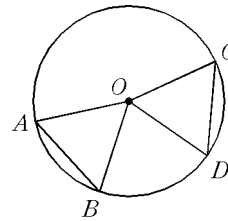
50. Given: $\overline{WV} \cong \overline{VY}$, $\angle WVX \cong \angle YVX$

Prove: $\angle WZX \cong \angle YZX$
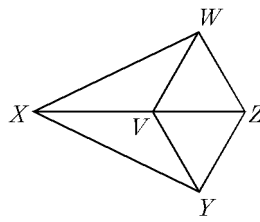
statement	reason
1. _____	1. Given
2. _____	2. Reflexive property
3. $\triangle XVW \cong \triangle XVY$	3. _____
4. _____	4. Corr sides of $\cong$ $\triangle$s $\cong$
5. _____	5. Reflexive Property
6. $\angle WXZ \cong \angle YXZ$	6. _____
7. $\triangle XWZ \cong \triangle XYZ$	7. _____
8. _____	8. _____

Algebra 2 Samples

1. The great white shark in the novel, <u>Jaws</u>, had a mass of 4200 kg. The length of a great white shark can be approximated using the formula $\ell = 0.5m^{\frac{1}{3}}$ where ℓ is the length of a great white shark in meters, and m is its mass in kilograms. How long was the shark, to the nearest tenth of a meter, according to this formula?

2. The formula for the skin area of a human, A, in square meters is related to the height, h, of the person in centimeters, and their weight, w, in kilograms by the following formula:

    $$A = 0.025 \times h^{0.42} \times w^{0.5}$$

    Solve this formula for w.

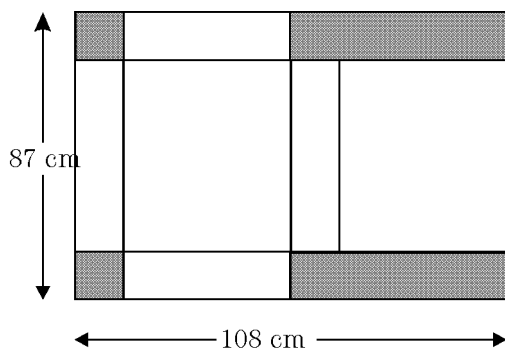3. Find f and g so that $(2f+3g)+(5f-2g)i = 13+4i$.

4. Consider the four expressions: $x + 1$, $x - 1$, $x^2 + 1$, and $x^4 + 1$. How many of these are factors of $x^5 - x^4 + x - 1$?

5. A box is to be constructed from cardboard 108 cm long and 87 cm wide. This box has a top that is made from the same piece of cardboard (see diagram). What are the dimensions of the box with the maximum volume?

6. A beam is supported at one end by a wall and at the other end by a support. Because of its own weight the beam will be deflected from the horizontal. The equation of the deflection is given by the equation:

    $$y = -x^4 + ax^3 + bx^2$$

    where:

    > y equals the deflection of the beam in centimeters, and

   > x equals the distance of the beam from the wall in meters.

    a) If the support is 9 m from the wall (the deflection is 0 at this point) and the deflection at a point 2 m from the wall is found to be -364 cm (the negative sign indicated the deflection is downward) what are the values of a and b?

    b) What is the deflection 3 m from the secured end?

7. In the expression $\dfrac{w^2 - 25}{w^2 + 5w}$, what values are not allowed for w?

    ○ 0

    ○ 1

    ○ 5

    ○ -1

    ○ -5

8. Kamini knows that the speed of a car before it brakes suddenly is a function of the length of the skid marks left by its tires on the road and that the equation of the function is given by $s = 14\sqrt{d}$, where d is the length of the skid marks (in meters), and s is the speed of the car (in km/h), before the brake pedal is pushed. If she had to brake suddenly for a stop sign and left skid marks 50 m long, at what speed was she traveling before she had to break?

9. A substance doubles in volume every two minutes. At 10:00 am a small amount of the substance is placed in a container. At 11:00 am the container just fills. At what time was the container one-quarter full?

10. A 10 m length of copper wire is cut into three pieces. If the first piece is doubled the total length is 13 m. The sum of twice the first, the second and 3 times the third is 22. What are the lengths of the pieces of wire?

11. The fence around a rectangular piece of property is 64 m long. If the area of the property is $255\,\text{m}^2$ find the width of the property.

12. Graph the solution of the system as a region on the plane. (That is, the region where the two graphs overlap).

$$x > (y - 3)^2$$
$$x^2 + (y - 3)^2 \leq 9$$

13. The 42nd term of an arithmetic sequence is 102 and the common difference is 4. What are the first 5 terms?

14. State the common ratio, the 5th term, and the 8th term for the geometric sequence $-\dfrac{\sqrt{5}}{27}$, $\dfrac{5}{9}$, $-\dfrac{5\sqrt{5}}{3}$, ...

15. In an arithmetic sequence, $a_{10} = 17x - 11y$ and $a_{15} = 7x - 6y$. Find a_{25} and the sum of the first 25 terms.

16. Fred is on a sled coasting down a snowy hill. He covers 4 feet in the first second, 7 feet in the next second, 10 feet in the third second, and in general, 3 feet more each second than the previous second. If Fred arrives at the bottom of the hill at the end of 12 seconds, how far did he coast? How many feet did he cover in the last second?

17. One-tenth of a chemical in a tank evaporates each time the tank is opened for inspection. What percent of the original amount of chemical will remain in the tank after 6 inspections?

18. Which of the functions have an inverse that is a function?

○ $f(x) = x^3 - 3x^2 - 2$

○ $g(x) = -x^4 + 5$

○ $h(x) = x^3 + 2x^2 + 2x - 3$

19. If $f(x) = x^2 - 1$, $x \geq 0$, and $g(x) = \sqrt{x + 1}$, $x \geq -1$, prove that f and g are inverse functions of each other and sketch the graphs of f and g on the same coordinate plane.

20. How is the graph of $y = \dfrac{8}{x - 5}$ related to the graph of $y = \dfrac{1}{x}$?

○ vertical expansion by a factor of 8

○ vertical compression by a factor of $\frac{1}{8}$

○ translation of 5 units right

○ translation of 5 units left

21. Determine which of the following are parabolic equations.

○ $y^2 + 2y - 16 - x = 0$

○ $x^2 - 2x + y^2 - 3y = 0$

○ $y = \sqrt{x^2 + 5x + 6}$

○ $x = (y - 10)^2 - 2y + 5$

Algebra 2 Samples

22. Given the graph of the circle $(x-2)^2+(y+3)^2=9$. Which of the following are on the circle?

○ $(5, -3)$

○ $(4, -0.7)$

○ $(2, 0)$
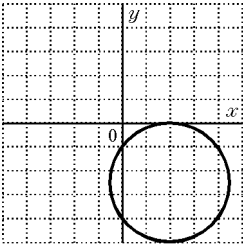
23. The parabola $y = x^2$ is changed to the form $y = a(x - p)^2 + q$ by translating the parabola 2 units down and 3 units left and expanding it vertically by a factor of 4. What are the values of a, p, and q?

24. A perfectly round log of radius 25 cm is sawed flat on one side. If the cut angle makes a 25° angle with the horizontal, how wide is the flat part of the log? (answer to the nearest tenth of a centimeter.)
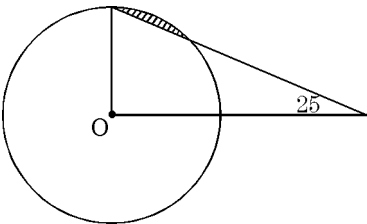

25. According to Kepler's Laws, planets have elliptical orbits, with the sun at one of the foci. The farthest Mercury gets from the sun is 70 million kilometers. The closest it gets to the sun is 46 million kilometers. Find the equation of the orbit of Mercury.

26. The number of mice in a certain field is increasing exponentially. On day 0, there were 125 mice. Ten days later there were 136 mice.

a) How many mice will there be on day 25?

b) On what day will the mouse population have tripled?

27. Solve the right triangle if $\angle B = 58.7°$ and $c = 15.1$ millimeters. Give lengths to 3 significant figures and angles to the nearest tenth of a degree.
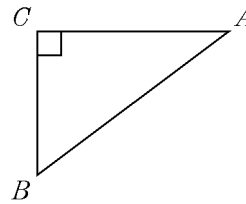

28. Given the figure, determine the value of x and y, correct to 1 decimal place.
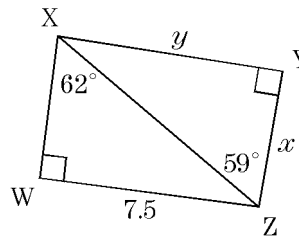

29. Find to the nearest tenth of a degree the angle opposite of the base of an isosceles triangle given the base of the triangle is 164.8 cm and the two congruent sides have length 84 cm.

30. Mont Blanc, the highest of the Alps, is 4.8 km high. The angles of elevation from points A and B are 43° and 54° as shown. Calculate the length of the tunnel $(\overline{AB})$ to the nearest tenth of a kilometer.

Algebra 2 Samples
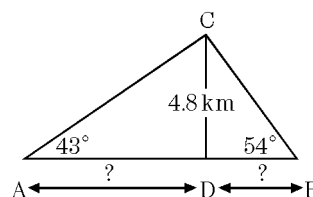
31. In triangle *RST*, $s = 20$ and $m\angle T = 60°$. Find the range of values of t for which there are two possible measures for $\angle S$.

32. Daniel is at point *D* and Edward is at point *E*. Daniel looks up at an angle of $63°$ from $\overline{DE}$ to see the top of the Eiffel Tower at *T*, and Edward looks up at it with an angle of $31°$. The length of $\overline{DE}$ is 346.4 m. How high is the Eiffel Tower to the nearest tenth of a meter?
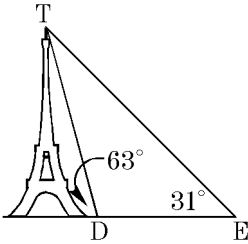

33. Two lions leave their den at the same time to look for game on the tundra. One runs at an average speed of 23 km/h on a bearing of $227°$. The other averages of 18 km/h on a bearing of $251°$. How far apart, to the nearest tenth of a kilometer, are the two lions after 3 h?

34. A field is in the shape of a triangle as shown. Find the area of the field to the nearest square meter.
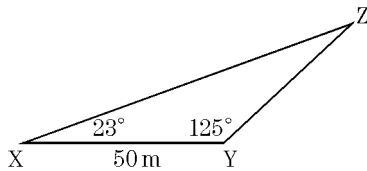

35. Determine the length, to 1 decimal place, of the arc that subtends an angle of 4 radians at the center of a circle with radius 6.3 cm.

36. How many inches will the weight in the figure rise if the pulley is rotated through an angle of $240.4°$?
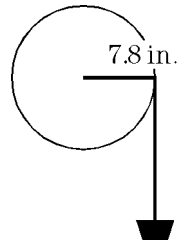
37. A satellite travelling in a circular orbit 1600 kilometers above earth takes two hours to make an orbit. Assume that the radius of the earth is 6400 kilometers.

   a) Find the linear velocity, in kilometers per hour, of the satellite.

   b) Find the number of kilometers travelled in 4.5 hours.

38. The "pepperoni" sector of a pizza has an area of $24\pi \, \text{in}^2$. If the pizza has a radius of 8 in., what is the measure of the central angle, in degrees, of the sector?

39. If the equation of the graph shown is written in the form $y = a \cos b(x - c) + d$ find the value of *d*.
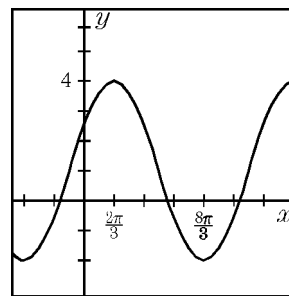
40. The voltage E in an electrical circuit is given by $E = 3.8 \cos 40\pi t$, where t is time measured in seconds.

    a) Find the amplitude and the period of the function.

    b) Find the frequency (the number of cycles completed in one second).

    c) Find E when $t = 0.02, 0.04, 0.08, 0.12, 0.14$

    d) Graph one period of E.

41. What do the functions $y = -4 \sin x$ and $y = -4 \cos \frac{x}{2}$ have in common?

    ○ period $= 2\pi$

    ○ maximum value of y

    ○ minimum value of y

    ○ x-intercepts

42. Consider the function $y = 5 - 2 \cos 3(x + \frac{\pi}{6})$. Without actually graphing the function, write an explanation of how the constants 5, −2, 3, and $\frac{\pi}{6}$ affect the graph, using the graph of $y = \cos x$ as a basis for comparison.

43. Which of the following are identities?

    ○ $\sin(-x) = -\sin x$

    ○ $\cos(-x) = \cos x$

    ○ $\tan(-x) = -\tan x$

    ○ $\cos(-x) = -\cos x$

44. Water in a hemispherical bowl with a diameter of 30 cm begins to pour out when the bowl is tilted to an angle of θ equal to 22°. How deep is the water in the bowl? Round off your answer to the nearest tenth of a centimeter.
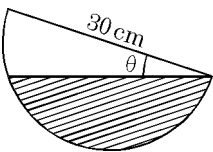

45. The graph shows how the height of a bicycle pedal changes as the bicycle is pedaled at a constant speed.
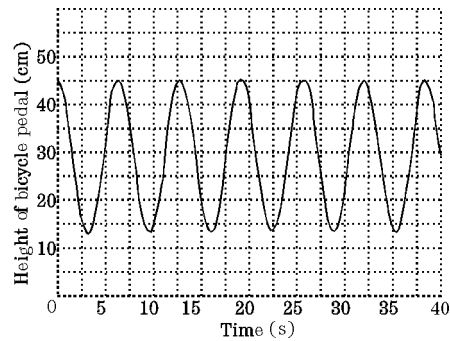
How would the graph change if a smaller bicycle was used but pedalled at the same rate?

46. Express the product of the polar coordinates $(3, \frac{\pi}{4})$ and $(4, -\frac{\pi}{12})$ in $a + bi$ form.

47. For the function $y = f(x)$, what does the quotient $\dfrac{f(x_2) - f(x_1)}{x_2 - x_1}$ represent?

48. Given the function $y = x^3 - 5x^2 + 4x$.

    a) Find the zeroes.

    b) Find the critical points.

    c) Find where the function is increasing and where it is decreasing.

    d) Sketch the function.

49. The graph of $y = f(x)$ is shown. How could the last row of the table be completed to show the sign of $f'(x)$?

x	−4	−3	−1	0	1
$f(x)$			2	3	4
$f'(x)$					
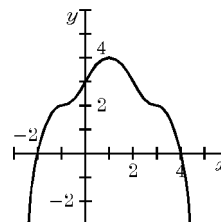
50. The position of a particle is given by

$$s(t) = t^2 - 8t + 4, \ \ t \geq 0$$

where s is measured in meters and t in seconds. Find all values of t for which the particle moves in the negative direction?