Summer Math Practice

Review of Algebra

(incoming 9th grade Algebra 2/ Geometry)

West Rocks School is pleased to provide you with a variety of suggested summer math activities, designed for students to practice and review skills that are necessary to be ready for the next grade level in math. These activities are not a school requirement but are offered to help students who want to ensure they have a solid grasp of the math concepts they learned this school year.

Enclosed you will find a variety of skill-based math problems that review the main concepts from your student's math course this past school year, along with an answer key. Each concept has been paired with sections from IXL that students can use for additional practice. As an added resource, IXL provides a worked-out solution for every problem with explanations to aid students in correcting their mistakes.

NOTE: IXL is only available till July 31st! I encourage you to maximize the opportunity.

A wealth of additional resources and activities can be found on the West Rocks Mathematics website, which is located on the West Rocks website under *Academics–Summer Learning-Mathematics*. You do not need to be logged into the school website to have access to these resources.

The username for IXL is the same as the students' username for school with @norwalkps added to the end. The password for IXL is the students' ID number, which is also their lunch pin number.

Exponents

Identify the base and exponent in each expression.

a) $(-\frac{1}{5})^{-3}$ b) $-\ 0.92^{4}$

Write in exponential notation.

c) $2 \cdot 2 \cdot 2 \cdot 2$ d) $\frac{3}{4}k \cdot \frac{3}{4}k \cdot \frac{3}{4}k$

Write the prime factorization of each number in exponential notation.

e) 3, 780 f) 6, 930

Expand and evaluate each expression.

g) $(-6)^2$ h) -5^6 i) $(\frac{1}{2})^4$

Simplify each expression. Write your answer using a positive exponent.

j) $(-3)^{-1} \cdot (-3)^0$ k) $5m^3n^4 \cdot 4m^5n^2$

l) $x^8z^5 \div x^3z^9$ m) $(\frac{72b^{-1}}{36c^{-1}})^{-2}$

n) $\frac{(9^{-2})^{-2} \cdot 2^2}{9^2}$ o) $\frac{6^8 \cdot 56^{-3}}{6^5 \cdot 7^{-3}}$

Solve each equation involving a variable that is squared.

p) $r^2 = 256$ q) $c^2 = \frac{121}{169}$

Solve each equation using a variable that is cubed using a calculator.

r) $x^3 = 32.768$ s) $t^3 = -\frac{27}{343}$

t) The expanded form of a number is $5 \cdot 10^1 + 8 \cdot 10^0 + 1 \cdot 10^{-1} + 9 \cdot 10^{-2}$. What is this number in standard form?

Scientific Notation

Tell whether each number is written correctly in scientific notation. If incorrectly written, state the reason.

a) $10 \cdot 10^{2}$

b) $0.99 \cdot 10^{12}$

c) $1.4 \cdot 10^{2}$

d) $0.4 \cdot 10^{25}$

Write each number in scientific notation.

e) 25,300

f) 0.00083

Write each number in standard form.

g) $2.54 \cdot 10^{2}$

h) $6.2 \cdot 10^{-4}$

Identify the greater number in the pair of numbers.

i) $7.8 \cdot 10^{-5}$ and $5.4 \cdot 10^{-7}$

Evaluate. Write your answer in scientific notation.

j) $2.44 \cdot 10^{3} + 1.9 \cdot 10^{5}$

k) $3.12 \cdot 10^{-3} - 3 \cdot 10^{-3}$

l) $2.4 \cdot 10^{-2} \cdot 5 \cdot 10^{-1}$

m) $3.2 \cdot 10^{8} \div (1.6 \cdot 10^{4})$

Algebraic Linear Equations

Solve each linear equation.

a) $2(x - 5) - 8 = 20$

b) $2x - (5 - x) = \frac{5}{2}$

c) $\frac{1}{4}(x + 2) - 2 = 0.5$

d) $4x - \frac{5-2x}{5} = \frac{3}{5}$

e) $\frac{2(2x+1)}{5} - \frac{x+2}{3} = \frac{1}{5}$

f) $\frac{x+3}{2} - \frac{11-x}{5} = 1 + \frac{3x-1}{20}$

Write each repeating decimal as a fraction.

g) $0.\overline{2}$

h) $0.9\overline{3}$

i) $0.2\overline{3}$

j) $0.3\overline{16}$

Tell whether each equation has one solution, no solution, or an infinite number of solutions.

k) $2x + 4 = -2(\frac{1}{2} - x)$

l) $6y + (16 - 2y) = 4(4 + y)$

m) $4x + 5 = 2x - 7$

Find the value of y when x = 4.

n) $4x - 2 = y + 5$

o) $\frac{3y+2}{4} = 2x$

Express x in terms of y. Find the value of x when y = -2.

p) $4x + y = 2(x + 3y)$

q) $\frac{y}{2} - \frac{2x+y}{5} = 7$

r) Mabel paid $2.95 for a granola bar with dimes and quarters. She used 5 fewer quarters than dimes. How many dimes and quarters did she use to pay for the granola bar?

s) Sylvia is carrying two bags of potatoes, Bag A and Bag B. The weight of Bag B is 3 pounds more than twice the weight of Bag A. The total weight of both bags is 27 pounds. Find the weight of each bag of potatoes.

Linear Equations & Inequalities

Find the slope of the line through each pair of points.

a) P(4, 5), Q(0, -3)

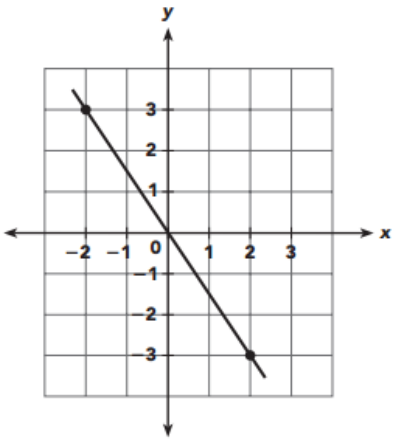
b) W(9, -2), X(9, 8)

c) R(-8, 2), S(-3, -3)

d) Y(7, 4), Z(3, 4)

Write an equation in slope-intercept form for each line.

e)



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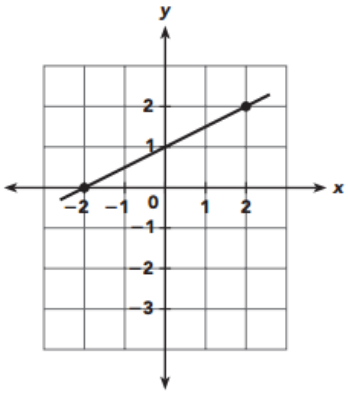


Find the slope and y-intercept of each equation.

g) $4x - 3y = 9$

h) $-5x + 2y = 6$

i) A line has a slope $-\frac{3}{4}$ and passes through the point (8, 3). Write an equation of the line.

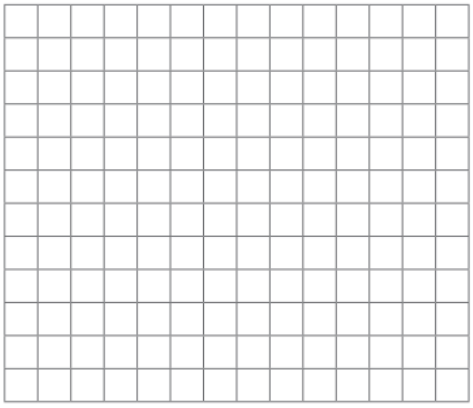
j) A line has the equation 4x - 3y + 9 = 0. Find an equation of the line parallel to this line that has a y-intercept of -1.

k) Find an equation of the line that passes through the point (-3, -2) and is parallel to 2x = 3 - 5y.

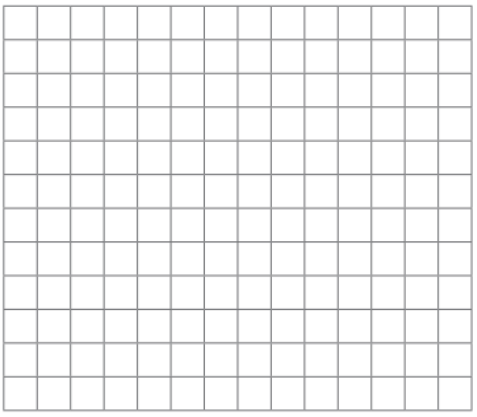
l) Find an equation of the line that passes through the pair of points (1, -6) and (-4, 9)

Graph each linear equation.

m) $y = \frac{3}{5}x + 3$



n) $y = 5 - 2x$



Solve each inequality. Graph the solution on a number line.

o) $13 + 9q > -5$

p) $-5x \geq 2(7 + x)$

q) $9 + 2y < 10y - 15$

r) $5(p + 4) \leq 3(p - 4) - 2p$

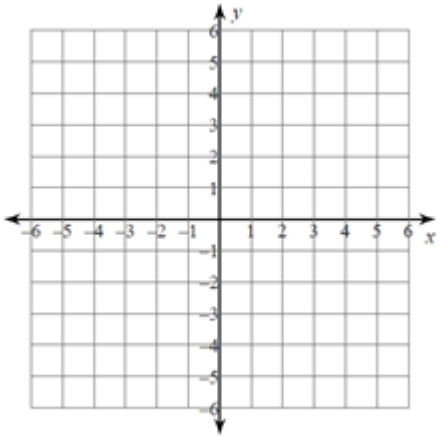
Solve each compound inequality. Graph the solution set.

s) $-80 < 8(3y + 2) \leq 40$

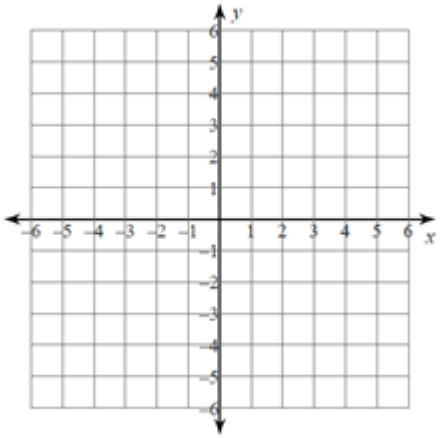
t) $y - 7 < 15, \text{ or } y + 12 \geq 38$

Graph each linear inequality.

u) $y > -5$



v) $y \leq \frac{1}{2}x + 2$



Systems of Linear Equations & Inequalities

Solve each system of linear equations using elimination or substitution.

a) $3x + 5y = 35$
$6x - 4y = -28$

b) $7m - 2n = -13$
$2n - 5m = 11$

c) $9m + 4n = 38$
$2m = 5n - 21$

d) $5w - 4v = 1$
$v = 6w + 14$

Write and solve each system of linear equations.

e) Jenny purchased 26 magazines for her project research at a total cost of $134. The art related magazines cost $4 each, while the science related magazines cost $7 each. Find the number of art related magazines and science related magazines purchased.

f) A total of 95 theme park tickets were sold for $960. Each adult ticket cost $12 and each child's ticket cost $9. Find the number of adult tickets and the number of children's tickets sold.

g) Adam bought 5 packets of roasted peanuts and 3 packets of beef jerky for $37.80. Joe bought 3 packets of roasted peanuts and 2 packets of beef jerky for $23.87. Find the cost of a packet of roasted peanuts and a packet of beef jerky.

h) The sum of two numbers is 31. Twice the larger number is 7 more than 3 times the smaller number. What are the numbers?

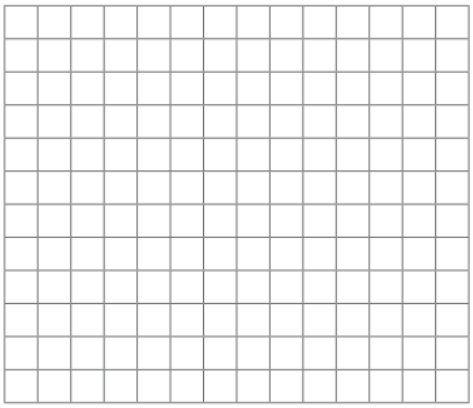
State whether each system is inconsistent, dependent, or has a unique solution.

i) $8x + 4y = 14$
$2x + y = 28$

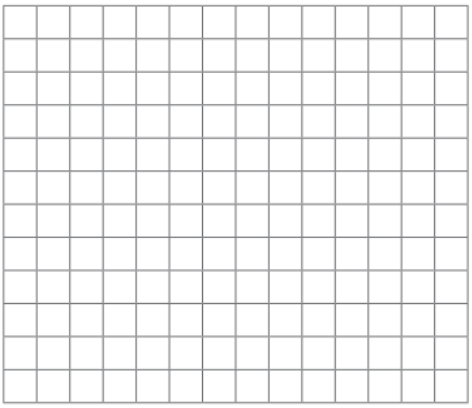
j) $12x - 3y = 9$
$4x - y = 3$

Solve each system by graphing.

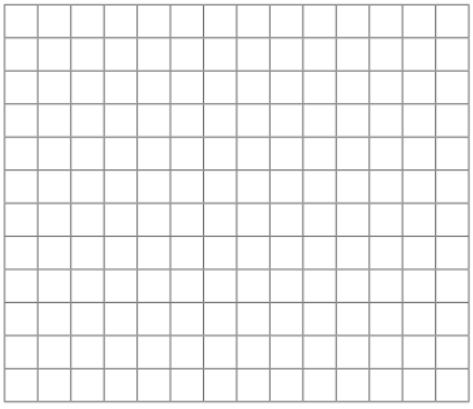
k) $x = 5y$ and $y = x - 4$



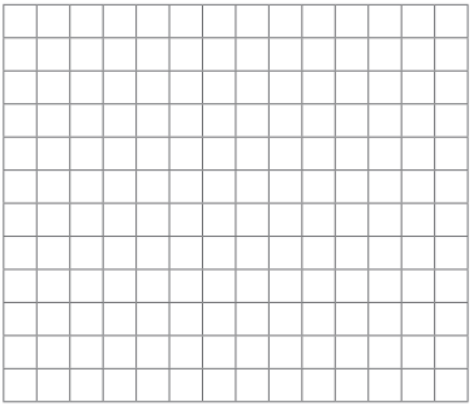
l) $x = 4$ and $y = 3x - 5$



m) $y \leq -x - 2$ *and* $y \geq -5x + 2$



n) $y > 2$ *and* $4x + y < 2$



Functions

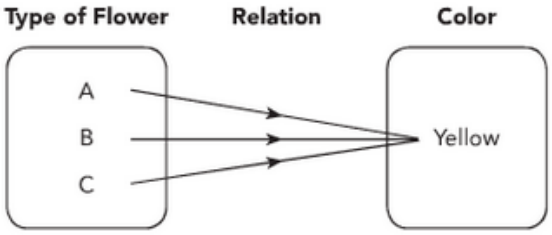
Given the relation described, identify the input and the output.

a) Daphne wants to find the area of a circle given its radius.

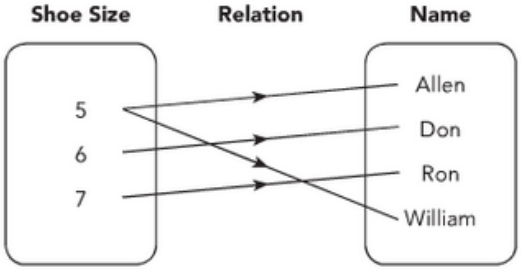
b) Mr. Reynard wants to find the total cost of the items he bought at a store where everything costs one dollar.

Based on the mapping diagram, state the type of relation. Tell whether each relation is a function.

c)

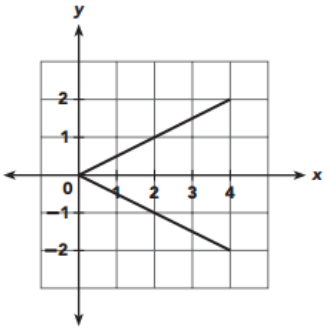


d)



Tell whether the relation represented by each graph is a function.

e)



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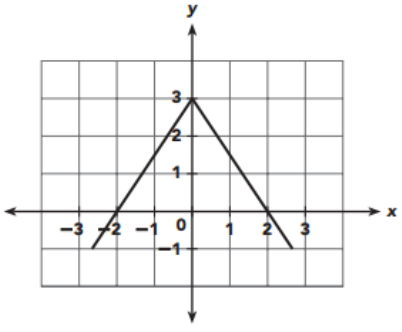


Tell whether each table represents a linear or nonlinear function.

g)

x	1	3	5	7
y	2	18	50	98

h)

x	-4	0	4	8
y	4	5	6	7

Express each relation as a mapping diagram. Then determine the domain and range, and the type of relation.

i) {(0, 0), (-3, 2), (6, 4), (-1, 1)}

j) {(5, 2), (5, 6), (3, -2), (0, -2)}

Determine whether each relation is a function.

k) {(5, -7), (6, -7), (-8, -1), (0, -1)}

l) $y = -8$

m) $x = 15$

n) $y = 3x - 2$

If $f(x) = 6x + 7$ and $g(x) = x^2 - 4$, find each value.

o) $f(-3)$

p) $f(m)$

q) $g(a) + 9$

r) $g(-4t)$

s) $f(q + 1)$

t) $f(2) + g(2)$

If $f(x) = -2x - 3$ and $g(x) = x^2 + 5x$, find each value.

u) $5[f(d)]$

v) $3[g(n)]$

Polynomials & Factoring

Name each polynomial by degree and number of terms. Then write the polynomial in standard form.

a) $7y^4m^2$

b) $-9b^3 + 6b^7 – 7b^5 + 32b^9$

Simplify each polynomial by performing the operation that is indicated.

c) $(6x^2 + 3x + 7) + (2x^2 – 6x – 4)$

d) $(17v^2 – 8) + (17v^2 + 10 + v^3) – (4v^2 – 4)$

e) $(9k – 9 – 12k^4) – (4k + k^4 + 4) – (10 + 7k)$

f) $8r^2(4r^2 – 5r + 7)$

g) $(5x + 6)(8x – 4)$

h) $(3x - 3)(x - 4)$

i) $(2y – 5)(y^2 – 6y + 3)$

j) $(6n^2 – 6n – 5)(7n^2 + 6n -5)$

k) $(2k^2 + 1)^2$

l) $(x – 5)(x + 5)$

m) $(3x + 2)(2x – 1) - x(x+3)$

n) $(a + b + c)(a + b – c) – (a + c)(a – c)$

o) $(n^3 + 7n^2 + 14n + 8) \div (n + 2)$

p) $(x^2 + 5x – 6) \div (x – 1)$

Factor completely. If prime, write prime.

q) $18m^2n^4 – 12m^2n^3 + 24m^2n^2$

r) $x^2 -6x + 8$

s) $9x^2 – 49$

t) $5x^3 – 20x^2 – 60x$

u) $15x^2 + 18x + 3$

v) $x^4 – 2x^3 + x^2$

Quadratic and Exponential Functions

Find the vertex, axis of symmetry, and max/min of each.

a) $y = x^2 - 3x$

b) $y = x^2 - 8x + 16$

How do the following graphs differ from $y = x^2$.

c) $y = -2x^2 - 2$

d) $y = \frac{1}{2}x^2$

e) Graph the equation $y = x^2 - 2x - 3$. Be sure to plot and label the following:

1) Axis of symmetry
2) Vertex
3) Y – intercept
4) Two additional points

Solve the following using square roots.

f) $7x^2 = -21$

g) $4r^2 + 1 = 325$

Solve each equation by factoring.

h) $(2n + 3)(4n + 3) = 0$

i) $k^2 - 8k + 16 = 0$

j) $-4n^2 + 6n - 16 = -5n^2$

k) $-2v^2 - v + 12 = -3v^2 + 6v$

Solve by completing the square.

l) $a^2 - 2a - 8 = 0$

m) $k^2 + 12k + 20 = 0$

Solve using the quadratic formula.

n) $x^2 + 2 = -3x$

o) $7x^2 - 2x = 8$

Find the discriminant of each quadratic equation. Name the number of real solutions.

p) $x^2 = 2x - 3$

q) $-2x^2 - 8x - 14 = -6$

r) Graph $3 \cdot 2^x$ when x is 0, 1, 2, 3, and 4

s) A builder tosses an orange with an upward velocity of 32 ft/sec to a friend who is 20 feet above the ground. The starting height of the orange is 5 feet. Vertical motion formula $h = -16t^2 + vt + c$.

1) How far above the ground will the orange be after 2 seconds?

2) Will the orange reach the friend?

Determine whether the given sequence is geometric. If so, find the common ratio.

t) -1, 6, -36, 216

u) 4, 16, 36, 64

Given the first term and the common ratio, find the equation for the nth term and the third term of the sequence.

v) $a_1 = -2$ $r = 6$

w) $a_1 = 2$ $r = 6$

Rational Expressions

Simplify each expression.

a) $\frac{m-5}{m^2-10m+25}$

b) $\frac{9-x}{x^2-81}$

c) $\frac{u+5v}{8v^2u^2} - \frac{u-6v}{8v^2u^2}$

d) $\frac{8}{7v-6} + \frac{4}{3v^2}$

e) $\frac{2x}{3x+3} - \frac{2}{x+5}$

f) $\frac{96}{38n} \cdot \frac{25}{45}$

g) $\frac{(p+6)(p-4)}{p-4} \cdot \frac{1}{(p-4)(p-2)}$

h) $\frac{b^2-2b-15}{8b+20} \div \frac{2}{4b+10}$

i) $\frac{10b^2+42b+36}{6b^2-2b-60} \div \frac{40b+48}{3b^2-13b+10}$

Write each mixed expression as a rational expression.

j) $\frac{2}{x} - 8$

k) $x^2 + \frac{x-1}{x+4}$

l) $(x - 2) + \frac{x-1}{x+2}$

Simplify each expression.

m) $\frac{\frac{g^2}{h}}{\frac{g^5}{h^2}}$

n) $\frac{\frac{j^2-16}{j^2+10j+16}}{\frac{15}{j+8}}$

Solve each equation. State any extraneous solutions.

o) $\frac{2}{x+1} = \frac{4}{x}$

p) $4 - \frac{p}{p-1} = \frac{2}{p-1}$

q) $\frac{n^2-n-6}{n^2-n} - \frac{n-5}{n-1} = \frac{n-3}{n^2-n}$

Radicals

Simplify each expression.

a) $\sqrt{56}$

b) $2\sqrt{25}$

c) $\sqrt{5} \cdot \sqrt{10}$

d) $5\sqrt{2} \cdot 6\sqrt{8}$

e) $\sqrt{28a^2b}$

f) $\frac{7}{5+\sqrt{3}}$

g) $\sqrt{\frac{27}{m^6}}$

h) $\frac{3}{\sqrt{7}-\sqrt{2}}$

i) $\sqrt{3v}(\sqrt{6} + \sqrt{10})$

j) $(-2\sqrt{3} + 2)(\sqrt{3} - 5)$

k) $3\sqrt{6} - 4\sqrt{6}$

l) $-2\sqrt{3} + 3\sqrt{27}$

m) $-3\sqrt{45} + 2\sqrt{12} + 3\sqrt{6} - 3\sqrt{20}$

Solve each equation. Check for extraneous solutions.

n) $5 = \sqrt{x + 3}$

o) $-12 = -6\sqrt{b + 4}$

p) $\sqrt{3n} = \sqrt{4n - 1}$

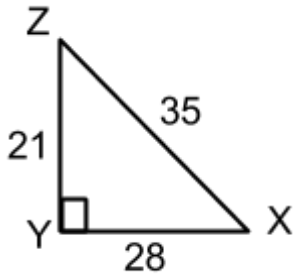
q) $p = \sqrt{2 - p}$

r) $\sqrt{-16 + 10a} = a$

s) $4 + \sqrt{-3m + 10} = m$

Pythagorean Theorem, Distance Formula, and Trigonometric Functions

Find the value of each trigonometric ratio. Write your answer as a simplified fraction.



a) cos X

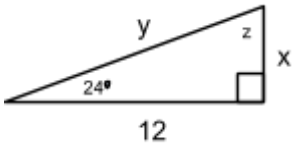
b) sin X

c) tan Z

d) cos Z

Solve each right triangle for the missing sides and angles.

e)



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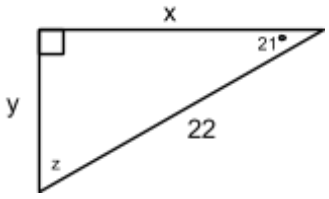
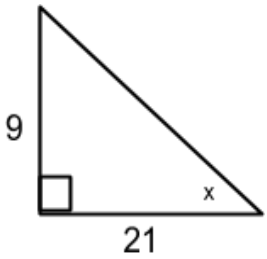


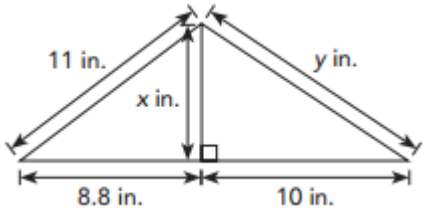
Find the measure of the indicated angle to the nearest degree.

g)

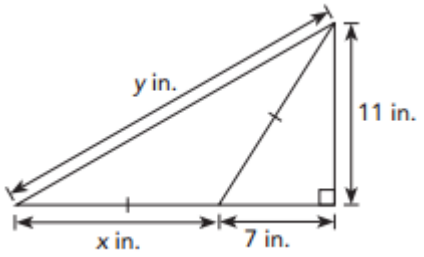


Find the value of x.

h)



i)



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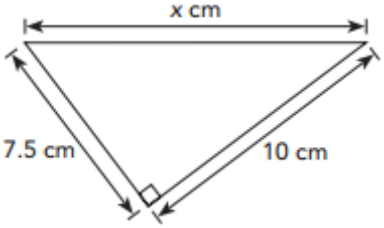
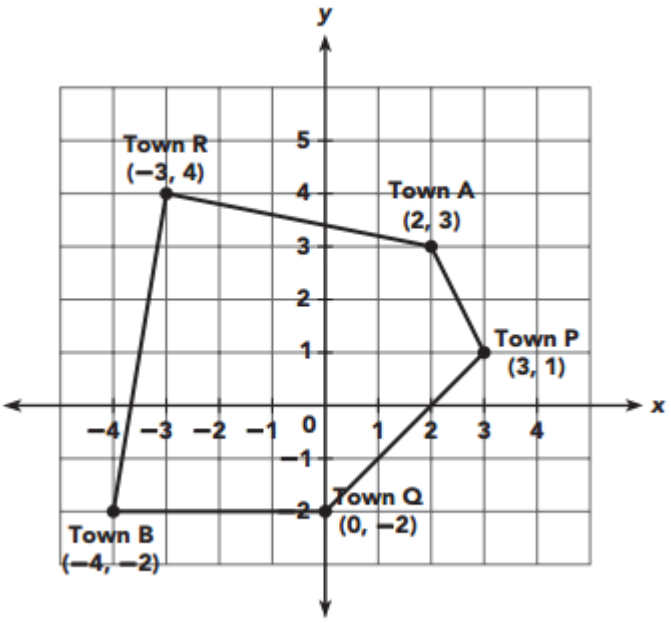


k) Town A and Town B are located at the points shown in the diagram. Mr. Appleton wants to drive from Town A to Town B. He can choose between the route that takes him through Towns P and Q, or the route that takes him through Town R. Each unit represents 1 kilometer.

1) Which is the shorter route?

2) What is the difference in distances of the two routes?



Answer Key

Exponents

a) base = $-\frac{1}{5}$, exponent = -3
b) base = -0.92, exponent = 4
c) 2^4
d) $(\frac{3}{4}k)^3$
e)$2^2 \cdot 3^3 \cdot 5 \cdot 7$
f) $2 \cdot 3^2 \cdot 5 \cdot 7 \cdot 11$
g) 36
h) -15,625
i) $\frac{1}{16}$
j) $\frac{1}{-3}$
k) $20m^8n^6$
l) $\frac{x^5}{z^4}$
m) $\frac{b^2}{4c^2}$
n) 324
o) $\frac{6^3}{8^3}$ or $\frac{27}{64}$
p) r = 16 and -16
q) c = $\frac{11}{13}$ and $-\frac{11}{13}$
r) 3.2
s) $-\frac{3}{7}$
t) 58.19

Scientific Notation

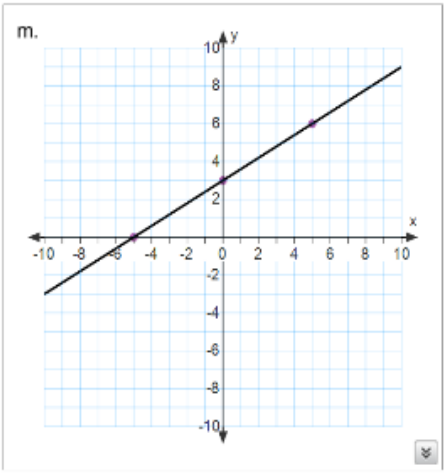
a) no, the base is greater than 10
b) no, the base is less than 1
c) yes
d) no, the base is less than 1
e) $2.53 \cdot 10^4$
f) $8.3 \cdot 10^{-4}$
g) 254
h) 0.00062
i) $7.8 \cdot 10^{-5}$
j) $1.9244 \cdot 10^5$
k) $1.2 \cdot 10^{-4}$
l) $1.2 \cdot 10^{-2}$
m) $2 \cdot 10^4$

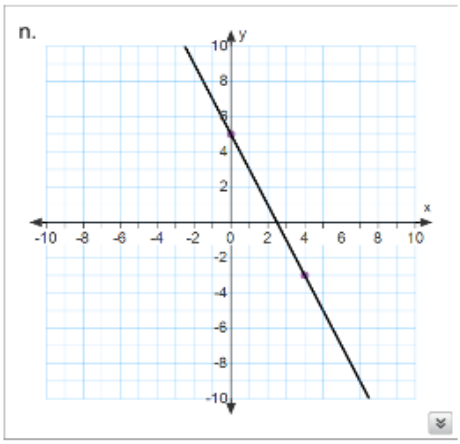
Algebraic Linear Equations

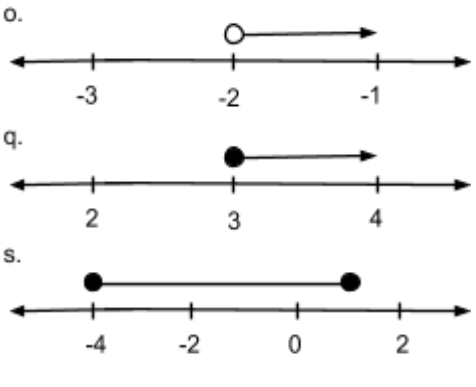
a) x = 19
b) x = 2.5
c) x = 8
d) x = $\frac{4}{15}$
e) x = 1
f) x = 3
g) $\frac{2}{9}$
h) $\frac{14}{15}$
i) $\frac{4}{15}$
j) $\frac{313}{990}$
k) no solution
l) infinite solutions
m) unique solution, x = -6
n) y = 9
o) y = 10
p) $x = \frac{5}{2}y$
q) $x = \frac{3y-7}{4}$
r) 7 quarters and 12 dimes
s) Bag A = 8 lbs and Bag B = 19 lb

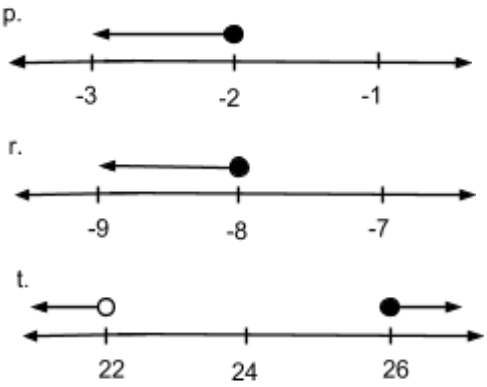
Linear Equations & Inequalities

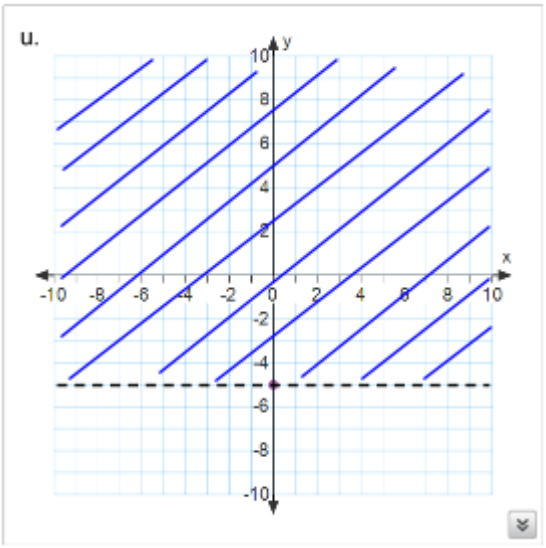
a) 2
b) undefined
c) -1
d) 0
e) y = -1.5x
f) y = .5x + 1
g) slope = 4/3, y-intercept = -3
h) slope = 5/2, y-intercept = 3
i) y = -.75x + 9
j) $y = \frac{4}{3}x - 1$
k) $y = \frac{-2}{5}x - \frac{16}{5}$
l) y = -3x - 3
m) See graph to the right
n) See graph to the right
o) q > -2
p) $x \leq -2$
q) $3 \leq y$
r) $p \leq -8$
s) $-4 \leq y \leq 1$
t) y < 22 or $y \geq 26$
u) See below
v) See below

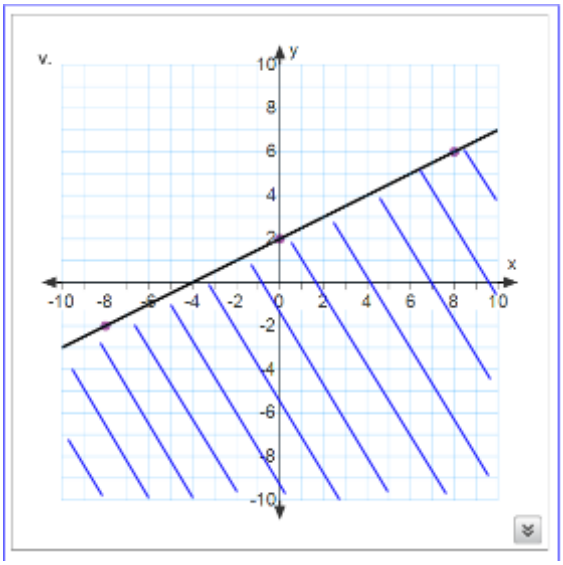








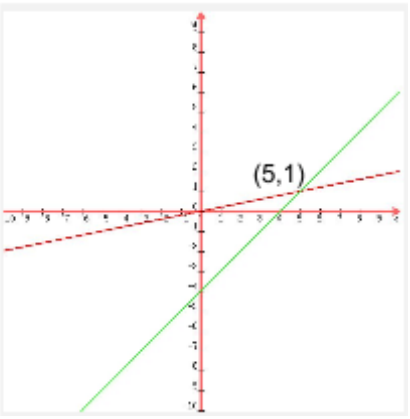




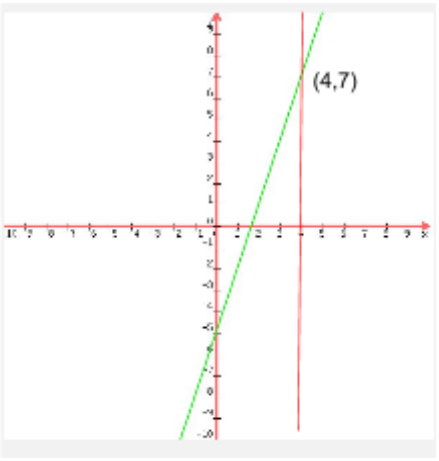
Systems of Linear Equations & Inequalities

a) (x, y) = (0, 7)
b) (m, n) = (-1, 3)
c) (m, n) = (2, 5)
d) (v, w) = (-4, -3)
e) 16 art magazines and 10 science magazines
f) 35 adult tickets, and 60 children's tickets
g) $3.99 for roasted peanuts, and $5.95 for beef jerky
h) The larger number is 20, and the smaller number is 11
i) Inconsistent
j) Dependent
k) See graph below.
l) See graph below.
m) See graph below.
n) See graph below.

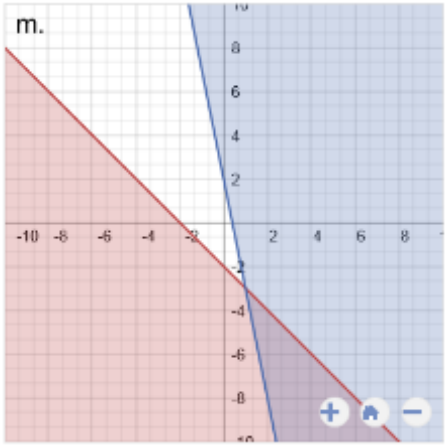
k.



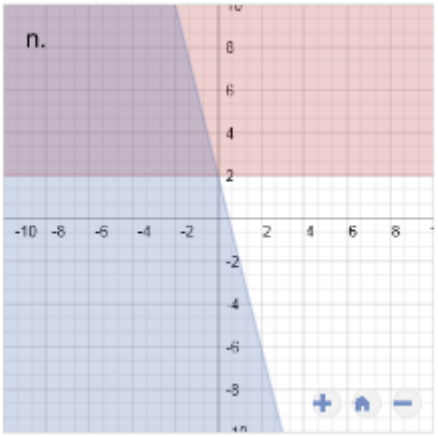
l.



m.

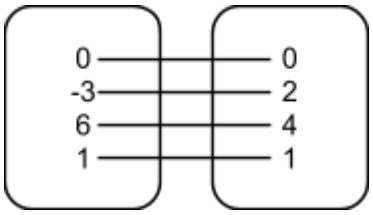


n.

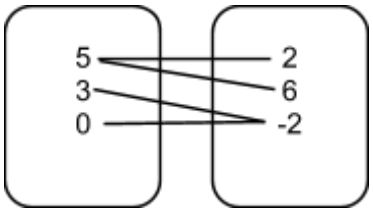


Functions

a) input - radius, output - area
b) input - number of items, output - total cost
c) many-to-one; yes
d) one-to-many; no
e) no
f) yes
g) nonlinear
h) linear
i) Domain = {-3, -1, 0 6}, Range = {0, 1, 2, 4}



j) Domain = {0, 3, 5}, Range = {-2, 2, 6}



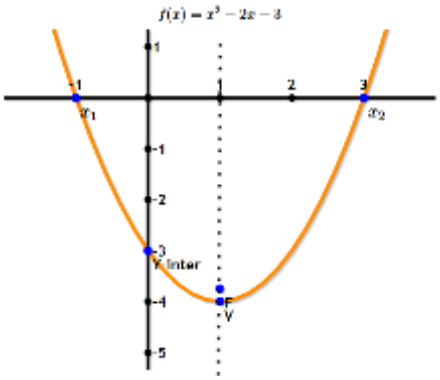
k) yes
l) yes
m) no
n) yes
o) f(-3) = -11
p) f(m) = 6m 7
q) g(a) + 9 = $a^2 + 5$
r) g(-4t) = $-16t^2 - 4$
s) f(q + 1) = 6q + 13
t) f(2) + g(2) = 19
u) 5[f(d)] = -10d - 15
v) 3[g(n)] = $3n^2 + 15n$

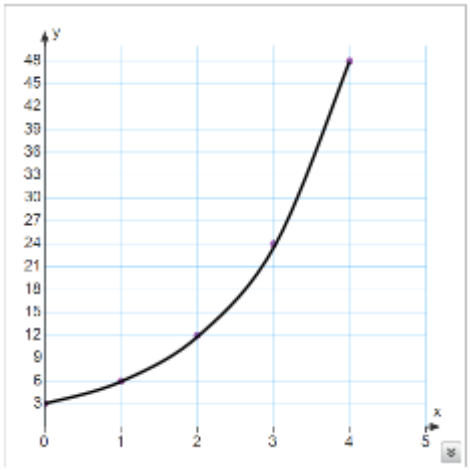
Polynomials & Factoring

a) degree 6 monomial
b) 4 term polynomial of degree 9
c) $8x^2-3x+3$
d) v^3+30v^2+6
e) $-13k^4-2k-23$
f) $32r^4-40r^3+56r^2$
g) $40x^2+28x-24$
h) $3x^2-15x+12$
i) $2y^3-17y^2+36y-15$
j) $42n^4-6n^3-101n^2+25$
k) $4k^4+4k^2+1$
l) x^2-25
m) $5x^2-2x-2$
n) $2ab+b^2$
o) n^2+5n+4
p) x+6
q) $6m^2n^2(3n^2-2n+4)$
r) (x-4)(x-2)
s) (3x+7)(3x-7)
t) 5x(x-6)(x+2)
u) 3(5x+1)(x+1)
v) $x^2(x-1)^2$

Quadratics & Exponential Functions

a) $(\frac{3}{2}, \frac{-9}{4})$, x = $\frac{3}{2}$, minimum at $(\frac{3}{2}, \frac{-9}{4})$
b) (4, 0), x = 4, minimum at (4, 0)
c) narrower, opens down, vertex is at (0, -2)
d) wider
e) axis of symmetry: x = 1, vertex: (1, -4), y-intercept: -3, additional points: (2, -3), (3, 0). See graph below.
f) no solution
g) r = ± 9
h) n = $\frac{-3}{2}$ or $\frac{-3}{4}$
i) k = 4
j) n = -8 or 2
k) v = 4 or 3
l) a = 4 or -2
m) k = -10 or -2
n) x = -2 or -1
o) x = $\frac{2 \pm \sqrt{228}}{14}$
p) -8, no real solutions
q) 0, one real solution
r) See graph to the right
s) 1) 5 ft, 2) max. height is 21 ft, so yes
t) yes, -6
u) no
v) $a_n = -2 * 6^{n-1}$, $a_3 = -72$
w) $a_n = 2 * 6^{n-1}$, $a_3 = 72$





Rational Expressions

a) $\frac{1}{m-5}$

b) $\frac{-1}{x+9}$

c) $\frac{11v}{8v^2u^2}$

d) $\frac{24v^2+28v-24}{3v^2(7v-6)}$

e) $\frac{2x^2+4x-6}{(3x+3)(x+5)}$

f) $\frac{80}{57n}$

g) $\frac{p+6}{(p-4)(p-2)}$

h) $\frac{(b-5)(b+3)}{4}$

i) $\frac{3b+2)(b-5)}{8(3b-10)}$

j) $\frac{2-8x}{x}$

k) $\frac{x^3+4x^2+x-1}{x+4}$

l) $\frac{x^2\ x-5}{x+2}$

m) $\frac{h}{g^3}$

n) $\frac{(j-4)(j+4)}{15(j+2)}$

o) x = -2

p) p = 2

q) n = -1 is extraneous

r) a = 2 and a = 8

s) no solution

Radicals

a) $2\sqrt{14}$

b) 10

c) $5\sqrt{2}$

d) 120

e) $2a\sqrt{7b}$

f) $\frac{35-7\sqrt{3}}{22}$

g) $\frac{3\sqrt{3}}{m^3}$

h) $\frac{3\sqrt{7}+3\sqrt{2}}{5}$

i) $3\sqrt{2v}\ +\ 30\sqrt{30v}$

j) $12\sqrt{3}\ -\ 16$

k) $-\sqrt{6}$

l) $7\sqrt{3}$

m) $-\ 15\sqrt{5}\ +\ 4\sqrt{3}\ +\ 3\sqrt{6}$

n) x = 22

o) b = 0

p) n = 1

q) p = 1

Pythagorean Theorem, Distance Formula, & Trigonometric Functions

a)$\frac{4}{5}$
b) $\frac{3}{5}$
c) $\frac{4}{3}$
d) $\frac{3}{5}$
e) z = 66 degrees, x = 5.3, y = 13.1
f) z = 69 degrees, x = 20.5, y = 7.9
g) 23 degrees
h) x= 6.6 in. and y = 12 in.
i) x=13 in. and y= 23 in.
j) x = 12.5 cm
k) 1) The shortest route is through P and Q. 2) The difference in the distance of two routes is 0.7 km