Knowledgebase Immersion Systems Solution  
*(KISS)*

*Making Sense of the MTLE Basic Skills Math Map*

Vance Holmes

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| **Seven Objectives** | | |
| I. | Understand the principles of geometry | (0015) |
| II. | Apply principles of algebra to expressions and equations | (0012) |
| III. | Apply principles of algebra to linear and nonlinear functions | (0013) |
| IV. | Understand measurement concepts | (0014) |
| V. | Demonstrate knowledge of data, statistics, probability, and discrete math | (0016) |
| VI. | Understand mathematical processes and perspectives | (0017) |
| VII. | Understand numbers and the number system | (0011) |

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| **Game Spin!** | |
| I. | Geometry Principles |
| II. | Algebra: Expressions / Equations |
| III. | Algebra: Linear / Nonlinear Functions |
| IV. | Measurement Concepts |
| V. | Statistics, Probability & Discrete Math |
| VI. | Processes & Perspectives |
| VII. | Number System |

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| **7** Seven Core Objectives  **21** Twenty-One Targets |

#### I. Understand the principles of geometry (0015)

1. analyzing polygons using attributes of sides, angles, and parallel and perpendicular lines
2. analyzing three-dimensional figures using attributes of faces, edges, and vertices
3. applying geometrical transformations (e.g., translations, reflections, rotations) to geometric figures and using the concepts of symmetry, similarity, and congruence to solve problems
4. using coordinate geometry to analyze geometric figures
5. using algebraic methods (e.g., Pythagorean theorem, coordinate geometry) to solve mathematical and real-world problems
6. analyzing arguments and justifying conclusions based on geometric concepts

#### II. Apply principles of algebra to expressions and equations (0012)

1. analyzing and extending a variety of patterns
2. using the concepts of variable, equality, and equation to generate, interpret, and evaluate algebraic expressions based on verbal descriptions
3. manipulating algebraic expressions and solving equations using a variety of techniques (e.g., performing operations, simplifying, factoring)
4. applying algebraic principles to represent and solve word problems involving fractions, ratios, proportions, and percents

#### III. Apply principles of algebra to linear and nonlinear functions (0013)

1. distinguishing between relations and functions
2. translating between different representations (e.g., tables, verbal descriptions, equations, graphs) of linear and nonlinear functions
3. relating the characteristics of a linear equation (e.g., slope, intercepts) to its graph
4. selecting a linear equation that best models a real-world situation, and interpreting the slope and intercepts in the context of the problem
5. selecting a nonlinear function that best models a real-world situation
6. solving linear equations, systems of linear equations, and inequalities symbolically and graphically
7. analyzing the graph of a nonlinear function (e.g., quadratic, rational, exponential)

#### IV. Understand measurement concepts (0014)

1. estimating and calculating measurements using metric, customary, and nonstandard units, unit conversions, and dimensional analysis in real-world situations
2. applying formulas to calculate perimeter, circumference, length, area, surface area, volume, and angles for two- and three-dimensional figures in mathematical and real-world situations
3. estimating and calculating measurements indirectly using the Pythagorean theorem, ratios, proportions, and the principles of similarity and congruence
4. determining how the characteristics of geometric figures (e.g., area, volume) are affected by changes in their dimensions
5. solving a variety of measurement problems (e.g., time, temperature, rates of change)

#### V. Demonstrate knowledge of data, statistics, probability and discrete mathematics (0016)

1. using measures of central tendency (e.g., mean, median) and spread (e.g., range) to draw conclusions and make predictions from data
2. selecting appropriate ways to display data and statistical information (e.g., tables, circle graphs, histograms)
3. analyzing and drawing inferences from data presented in different formats (e.g., frequency distributions, percentiles, graphs)
4. calculating probabilities for simple, compound, independent, dependent, and conditional events described in various ways (e.g., word problems, tree diagrams, Venn diagrams)
5. identifying real-world applications of topics in discrete mathematics (e.g., graph theory, combinatorics, algorithms, iteration)

#### VI. Understand mathematical processes and perspectives (0017)

1. selecting an appropriate problem-solving strategy for a situation (e.g., estimation, drawing a picture, working backward, using manipulatives)
2. using mathematical reasoning and principles of logic to evaluate arguments (e.g., distinguishing between inductive and deductive reasoning, applying principles of logic, using counterexamples, evaluating informal proofs) and determining the reasonableness of solutions to problems
3. translating between verbal descriptions and mathematical language, notation, and symbols (e.g., function notation, set notation, order relations)
4. identifying connections between mathematical concepts, other academic disciplines, and technology

#### VII. Understand numbers and the number system (0011)

1. demonstrating knowledge of the properties of integers, rational and real numbers, and number operations
2. demonstrating fluency in computation, including operations on decimals, percents, fractions, and exponents
3. using number sense and different number representations to solve mathematical and real-world problems

**Skillset & Systems Notation**

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| **S K I L L S E T** | Geometry Principles | **I.** |
| Analyzing polygons w/ attributes of sides, angles, parallel & perpendicular lines | | **A.** |
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| To find the area of a triangle, multiply the base by the height, and then divide by 2  The three angles of a triangle always add to 180°.  To make a triangle, the length of the third side must be less than the sum of the other two sides.  **Equilateral** Triangle has 3 equal angles, always 60°.  **Isosceles** Triangle has 2 equal sides.  **Scalene** Triangle has NO equal sides.  Note a special kind of right triangle call a **30-60-90 triangle**. That means that the angles of it are 30, 60 and 90 degrees. This also means that the dimension of the sides are special as well. They follow the **one-two-square root of three rule**. This means that sides will be proportional to each other where the shortest side equals n times one, the hypotenuse equals n times two and the remaining side equals n times the square root of three.  **H = Hypotenuse**  **Short Leg: SL = ½ H**  **Long Leg: LL = ½ H √ 3**  **combining the first two: LL = SL √ 3**  If the Hypotenuse H is 2 then . . . SL=½ of 2 = 1, LL = ½ of 2 \* √ 3  (The square root of 3 is about 1.73)  ***Find Ratio of the Areas of Two Triangles!***  test3_quest42  The ratio of the areas of the two similar triangles is:  4:3  **16:9**  4:1  8:3  **Step 1.Find the ratio of the lengths**  You must first of all find the length in the first triangle that corresponds to the length 3 in the second triangle. It is 4 since they face the same angle. The ratio of lengths is 4:3  **Step 2. Find the ratio of the areas**  If the lengths of similar shapes are in the ratio a : b, then their areas are in the ratio  a2 : b2  The ratio of the areas is 42 : 32 = 16 : 9  **==========**  **In any right triangle, the area of the square whose side is the hypotenuse (the side opposite the right angle) is equal to the sum of the areas of the squares whose sides are the two legs (the two sides that meet at a right angle).**  **This can be stated in equation form as**  **a2+b2=c2**  **where c is the length of the hypotenuse, and a and b are the lengths of the remaining two sides.**   |  | | --- | | test4_quest39  The line shown in the figure extends from the center of the square to the edge. What is the area of the square?  8  16  **64**  π \* 42  Since the line is from the center, we know that one side of the square is twice that length . . . or 8. **The area of any rectangle is length times width**. We further know that all sides of a square are the same length so the area of the square is:  length \* width = area  **8 \* 8 = 64** | |  | |  | | | |

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| **S K I L L S E T** | Algebra: Expressions / Equations | **II.** |
| **Theorem of Pythagoras** ?  Pre-Algebra – Order of Operations - Expressions | | **0.** |
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| X + 3 = 5  To solve an equation for a given variable (x), you need to **undo** whatever has been done to the variable. You do this in order to **isolate the variable**. Whatever you do on one side of the equation, you must do on the other.  Solve X + 6 = –3  –6 –6  X = –9  The "**undo**" of multiplication is division. If something is multiplied on the x, you undo it by dividing both sides (that is, dividing each term on both sides) of the equation by whatever is multiplied on the x:  Solve 2x = 5  Since the x is multiplied by 2, I need to divide both sides by 2  2x 5 5  2 = 2 so x = 2  The "**undo**" of division is multiplication:  Solve x/5 = –6  X = -6 \* 5 . .. x = -30  **Flip-n-Multiply**  There is one multiplication related special case: **When x is multiplied by a fraction** . . .  you "undo" this multiplication by dividing both sides of the equation by that fraction. To divide by a fraction, you **flip-n-multiply**. To isolate a variable that is multiplied by a fraction, just multiply both sides of the equation by the flip ("reciprocal") of that fraction. For example:  Solve 3/5 x = 10  5/3 (3/5 x) – (10/1) 5/3  5 3 = 10 5 50  3 \* 5x = 1 \* 3 x = 3  Since x is multiplied by 3/5, I'll want to multiply both sides by 5/3, to cancel off the fraction on the x. Many students find it helpful to also turn the 10 into a fraction, by putting it over 1.  **PEMDAS**  "Please excuse my dear Aunt Sadie"  Rule 1: Simplify all operations inside **P**arentheses.  Rule 2: Simplify all **E**xponents, working from left to right.  Rule 3: Perform all **M**ultiplications and **D**ivisions, working from left to right.  Rule 4: Perform all **A**dditions and **S**ubtractions, working from left to right.  An **algebraic expression** is one or more algebraic terms in a phrase. It can include variables, constants, and operating symbols (such as plus and minus signs). It's only a phrase, not the whole sentence, so it doesn't include an equal sign.  Algebraic expression: **3x2 + 2y + 7xy + 5**  In an algebraic expression, terms are the elements separated by the plus or minus signs. Terms may consist of variables and coefficients, or constants.  **Variables**  In algebraic expressions, letters represent variables. These letters are actually numbers in disguise. In this expression, the variables are x and y.  **Coefficients**  Coefficients are the number part of the terms with variables. In 3x2 + 2y + 7xy + 5, the coefficient of the first term is 3. (If a term consists of only variables, its coefficient is 1.)  **Constants**  Constants are the terms in the algebraic expression that contain only numbers. Terms without variables are called constants because their value never changes (here, 5).  **Graphing Linear Equations** is simple!  Graph y = 2x + 3  graph_line  Now that you have your points, you need to draw your axes – and label the axes with an appropriate scale.  graph_line3  Next, plot (draw) the points computed in the T-chart:  graph_line4  radical | | |

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| **S K I L L S E T** | Algebra: Linear / Nonlinear Functions | **III.** |
| relating **linear equation** characteristics (e.g., slope, intercepts) to a graph | | **C.** |
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| The **equation of a straight line** is usually written this way: **y = mx + b**   * y = how far up * x = how far along * b = y intercept (where the line crosses the y axis) * m = Slope   m needs some calculation: Change in Y  **m** = Change in X  test3_quest25  The equation of the straight line is:  y = (-2/3)x +3  y = (3/2)x + 3  **y = (-3/2)x + 3**  y = (-3/2)x - 3  **Rise** and **Run** are sometimes used instead of Y and X.  Rise is how far up. Run is how far along.  **Rise**  **m = Run**  To **find the slope**, use the following formula:  **Y1 – Y2**  **m = X1 – X2**  If the two points (X, **Y**) are (3, –2) and (9, 2) then . . .  (-2) **–** 2 –4 = 2  m = (3) – 9 = –6 = 3  Alternately  **Y2 – Y1**  **m = X2 – X1**  2 – (-2) 4 = 2  m = 9 – 3 = 6 = 3  =========================  What is the slope of the straight line passing through (2.5, 1) and (-2, 3.25)?  -0.5  0.5  -2  2.25  **Y2 – Y1**  **m = X2 – X1**  m = (3.25 – 1) 2.25  (–2 - 2.5) = –4.5 = **–0.5**  **Solve for “y =”**  3x – y = 5  3x – y + y = 5 + y  3(x) = 5 + y  3(x) = 5 + y  3x – 5 = 5 – 5 + y  3x – 5 = y  (since Y = mx + b . . . then)  **y = 3x + (- 5)** (or simply. . .) **y = 3x - 5**  = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =  Find the slope and y-intercept of the line with equation:  2x – y = 5  [First solve for “y =” . . . add y to both sides]  2x = y + 5  [Then . . . subtract 5 from both sides]  2x – 5 = y [The y is isolated, so . . .]  **y = 2x – 5**  [and, from the slope-intercept form of **y = mx + b**]  the slope is **m = 2** and the y-intercept is **b = –5**  = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =  Find the slope and y-intercept of the line with equation  4x + 5y = 12  5y = -4x + 12  y = (-4/5)x + 12/5  the slope is **m = -4/5** and the y-intercept is **b = 12/5**  = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =  The process of solving a formula for a given variable is called  "**solving literal equations**.”  Solve . . . P = 2l + 2w . . . for w  P – 21 = 2w  P – 21/2 = 2W/2  P – 21/2 = w  Q = (c + d)/2 for d  Q – c = d/2  2Q – c = d | | |
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| **S K I L L S E T** | Measurement Concepts | **IV.** |
| calculating measurements using metric, customary, and nonstandard units | | **A.** |
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| Rate = distance / time  **÷**  **To divide by a fraction**  **invert fraction & multiply**  A whole number divided by a fraction is calculated by  inverting the fraction and multiplying.  3 ÷ 1/3 = 3 \* 3/1 | | |

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| **S K I L L S E T** | Measurement Concepts | **IV.** |
| calculate perimeter, circumference, length, area, surface area, volume and angles | | **B.** |
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| Think of **Perimeter** as the length of fence needed to enclose the yard, whereas  **Area** is the space inside the yard.  To find the **perimeter of a polygon** –  add, to get the sum of the length of all sides.    The **area** **of a parallelogram**  is equal to its length times it width.    To find the  **area of a rectangle** – multiply length by width  **A = L \* W**    **area of a triangle** – multiply base by height, then divide by 2  **b \* h ÷ 2**    **area of a trapezoid** –sum of both bases, multiply by height, divide by 2  **(a+b) × h ÷ 2**  **Circle**  **Secrets**  **Circumference** is the distance around a circle. **Diameter** is the distance across a circle through its center. The diameter of a circle is twice as long as the **radius**.  circle_parts  **π Pi** represents the **ratio** of circumference to diameter   |  |  | | --- | --- | | **Pi π = 3.142** |  | | **The area** **of a circle** is the number of square units inside.  Area is Pi multiplied by Radius to the second power, or  A = Pi \* R2  **Formula for area of a circle:** | **A = π r2** | | **Formula for circumference of a circle:**  Area = two times Pi times radius . . . C = 2 \* π \* r . . . | **C = 2 π r** | | **Formula for diameter of a circle:**  Circumference = Pi multiplied by Diameter  . . . C = Pi \* D . . . | **C = πD** | | Volume of a box is length \* width \* height  The formula for the surface **area of a cone** is A = pr(r + s)  Volume of a cone  V = (1/3) π r2 h  **Volume of a Cylinder**  Although a cylinder is technically not a prism, it shares many of the properties of a prism. Like prisms, the volume is found by **multiplying** the area of one end of the **cylinder** **base** by its **height**.  Since the end (base) of a cylinder is a circle, the area of that circle is given by  A = π \* R2  Multiplying by the height h we get  **Volume =** π **R2 h** | |   test4_quest23  The diagram shows a section of pipe that is 10 feet long and has an internal diameter of 5 inches.What volume of water in cubic inches does the section of pipe hold?  3000π  **750π**  600π  600  Use the formula for the volume of a cylinder, V = πr2h  where h is the length of pipe = 10 feet = 120 inches  and r is the internal radius of the pipe = 2.5 inches.  V = πr2h = π \* (2.5)2 \* 120 = π \* 6.25 \* 120 = 750π cubic inches | | |

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| **S K I L L S E T** | Statistics, Probability & Discrete Math | **V.** |
| Measures of Central Tendency and Spread (range) | | **A.** |
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| M**ean** is the "average" -- add up all the numbers and then divide by the number of numbers. M**edian** is the "middle" value in the list of numbers. M**ode** is the value that occurs most often. If no number is repeated, then there is no mode for the list. R**ange** is just the difference between the largest and smallest values.  **mean**: regular meaning of "average"  **median**: middle value  **mode**: most often  http://www.purplemath.com/modules/meanmode.htm  **Use the Given Average to Calculate an Unknown**  The attendance at a weekly lecture program in the month of June **averaged 116** people. If there were 105 people attending the first week, 106 the second, and 125 the third, how many people attended the **fourth week**?  To find total attendance for all four lectures, **multiply** 116 by 4 -- 464. **Add** up the number who attended the first three weeks: 105 + 106 + 125 = 336. **Subtract** 336 from total -- 464 -- to find the fourth week attendance -- **128**. | | |

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| **S K I L L S E T** | Statistics, Probability & Discrete Mathematics | **V.** |
| Calculating Probabilities for events | | **D.** |
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| **Formula for the Probability of an Event**  the number of ways event A can occur  P(A) = the total number of possible outcomes  P(1) = # of ways to roll a 1 = 1  total # of sides 6  An **outcome** is the result of a single trial of an experiment (rolling a 1, or rolling a 2 etc). An **event** is one or more outcomes of an experiment (ie., rolling an *even* number).  nCk  **S T A T I S T I C S**  Three letters are chosen at random from the letters of the word **S T** A **T** I S **T** I C S.  (Each of the 10 letters can be chosen at most once.) The probability that the three letters are all the same is:  3/10  **1/60**  1/40  1/24  Explanation:  There are altogether "ten choose 3" (10C3) ways of selecting **3** letters from **10**. The general formula for choosing **k** members from a set of **n** members is  **nCk = n!** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  **[k!(n-k)!]**  Therefore  10C3 = 10! / [ 3! \* (10-3) !] =  10C3 = 10**!** / (3! \* 7!) =  (10 \* 9 \* 8) / (3 \* 2 \* 1) = 120  <--- 10! represents 10 \* 9 \* 8 \* 7 \* 6 \* 5 \* 4 \* 3 \* 2 \* 1.  **ISOLATE** by dividing 10! by 7! Which leaves (10 \* 9 \* 8) **720**  Over 3! which is (3 \* 2 \* 1) **6 REDUCE to 120**  There are then, **120 total ways** of choosing 3 letters from a group of 10 letters.  The question asks the probability that all 3 letters chosen will be the same. **Two letters**, namely **S** and **T**, **appear three times** in the word **S T** A **T** I S **T** I C S. Therefore, there are 2 ways that all three letters can be the same. There can be either 3 S's or 3 T's.  The probability that all three letters are the same is  **2/120 =** **1/60**  **The probability that all three letters are the same is therefore 2 / 120 = 1/6** | | |

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| **S K I L L S E T** | Number System | **VII.** |
| properties of integers, rational and real numbers, and number operations | | **A.** |
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| **Number Operations**  Positive + Positive = Positive  Negative + Negative = Negative  The sign for Positive + Negative (and vice versa) depends on which number is bigger.  Always subtract – then keep the sign of the higher number! For example,  **- 8 + 5 = -3** but  **-5 + 8 = 3**  **Good things happen to good people: Good**  **Good things happen to bad people: Bad**  **Bad things happen to good people: Bad**  **Bad things happen to bad people: Good**  Subtracting a negative is the same as adding a positive . . .  18 – (-16) = 18 + 16  **Rule:**  Minus of a minus is a plus  Minus times minus is plus  The **cancelation-of-minus-signs property** of multiplication!  Simplify:  –43 – (–19) – 21 + 25  –43 + 19 – 21 + 25  (–43) + 19 + (–21) + 25  (–43) + (–21) + 19 + 25  (–64) + 44  You can only move the numbers around *after* you have converted everything to addition . . . so . . .  44 + (–64)  You cannot reverse a subtraction, only an addition. In practical terms, this means that you can only move the numbers around if you move their signs with them.  44 – 64  Since 64 – 44 = 20 . . . then . . . 44 – 64 = **–20**  If the 2 numbers you are multiplying or dividing have the SAME sign (+,+) then  the result is POSITIVE    If the 2 numbers you are multiplying or dividing have DIFFERENT signs (+,-) then the result is NEGATIVE.  Calculate **exponents** using the cancelation-of-minus-signs property of multiplication. For instance, (3)2 = (3)(3) = 9 but . . .  Simplify (–3)2  (–3)2 = (–3)(–3) = (+3)(+3) = 9  Note the difference between the above exercise and the following:  Simplify –32  –32 = –(3)(3) = –9  -----------------------------------  Calculate **fractional exponents** [4(3/2)  = 8] first look at the numerator and denominator of the fractional exponent. Decide if it would be simpler to initially find the square root of 4, (denominator, 2) or to cubed root of 4 (numerator, 3) and calculate. Once you have done the first operation, do the second.  n1/2 = √n  n1/3 = 3√n  Since it's easy to take the square root of 4, do that first, then cube your result.  Take 4(3/2) in steps. Call it  (43)(1/2)  64(1/2)  = 8  Alternatively, call it (4^(1/2))^3  (4(1/2))(1/3)  23  = 8  The key to doing these problems is to recognize that you can set the base to an exponent of a\*b (separately, in other words), and it would be the same thing as the base to an exponent of ab. | | |

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| **S K I L L S E T** | Number System | **VII.** |
| Operations on decimals, percents, fractions, and exponents | | **B.** |
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| To **multiply fractions**, multiply the numerators by each other and the denominators by each other.  **Always reduce fractions!**  What is the ratio of the width of a rectangle to the length  if the rectangle is 4 ft wide and 24 ft long?  **1:6**  4:24  6:4  6:1  Because 4/24 reduces to 1/6  Calculate (3/4 + 7/8) / (13/5) ?  13/5  **5/8**  25/78  21/6  Explanation:  (3/4 +7/8) / (13/5)  = (6/8 +7/8) / (13/5)  = (13/8) / (13/5)  = (13/8) \* (5/13)  **= 5/8**  Which of the following is closest to **5/8**?  0.65  0.7  **0.62**  0.67  To multiply fractions – multiply the numerators then multiply the denominators.  To find 1/5 of 3/4, multiply 1/5 times 3/4.  1/5 \* 3/4 = 3/20.  To **convert a fraction to a decimal**,  divide the numerator by the denominator.  **5 / 8 = 0.625**     |  |  |  |  | | --- | --- | --- | --- | | **1/2**  **1/3**  **1/4**  **1/5**  **1/6** | **= .5**  **= .333**  **= .25**  **= .2**  **= .166** | **1/7**  **1/8**  **1/9**  **3/4**  **5/8** | **= .142**  **= .125**  **= .111**  **= .75**  **= .625** |   **Cross-Multiplying Fractions**  What is the value of x?  **7/35 = 12/x**  48  **60**  72  84  One way to evaluate equivalent fractions is by **cross multiplying**. The denominator of one fraction is multiplied by the numerator of the other fraction and vice versa:  7/35 = 12/x is cross multiplied to become:  7 \* x = 12 \* 35  7 \* x = 420  **x = 60**  ***Percent***  15% = 15/100 = 0.15  Fifteen percent is the same as the fraction 15/100 and the decimal 0.15. They all simply mean "fifteen out of a hundred."  We can find any percent of a given number by changing the percent to a decimal and multiplying. 85% = 0.85  To find 30 percent of 400: First change 30% to a decimal by moving the decimal point 2 places to the left. 30% = 0.30  Then multiply. 0.30 x 400 = 120  To add **integers** having the same sign, keep the same sign and add the absolute value of each number.  To add integers with different signs, keep the sign of the number with the largest absolute value and subtract the smallest absolute value from the largest.  **Integers** are whole numbers that describe opposites.  *Whole numbers* start at zero and go up by one forever.  *Counting numbers* are whole numbers greater than zero.  The **factors** of a number are those numbers that divide exactly into the number.  A *prime number* has only two factors: 1 and itself.  A *composite number* has more than two factors. (The number 1 is neither prime nor composite.)  Any number (except 0) raised to the zero power is equal to 1. 1490 = 1  Any number raised to the first power is always equal to itself. 81 = 8  Any number raised to the second power is **squared** -- to the third power, is **cubed**.  The *square of a number* is that number times itself. Finding the **square root** of a number is the inverse operation of squaring that number. The square root of a number √N is the number that gives N when multiplied by itself.  √100 = 10 √16 = 4  **5 Basic Exponent Rules**  **First basic exponent rule:** Whenever you multiply two terms with the same base, you can add the exponents:  (x3)(x4) (x7)  **Second rule:** Whenever you have an exponent expression that is raised to a power, you can multiply the exponent and power:  (x2)4 (x8)  **Third rule:** **Anything** **to the** **power zero is just 1** . . . so some exercises may be a lot easier than they first appear!  **Fourth rule:** **The square root of 1 is 1**. The numbers 2, 3 -- 5, 6, 7, 8 do not have an integer as a square root { 4, 9, 16, 25, 36, 49, 64, 81, 100 }  **Fifth rule:** The **only two** numbers that equal 1 when squared are 1 and -1.  **If x < 1 and x2 = 1, what is the value of x?**  **X must be -1 since we know x is less than 1**  **Sixth rule:** When dividing exponents, if the base number is the same, --  simply subtract the exponents.  For Example:  **58** divided by **56** is equivalent to  52  514  2514  25-14  *0.50000*  *0.40000*  **Rounding Decimals to the Nearest Hundredth**  If the thousandths place of a decimal is **four or less,** it is dropped and the hundredths place **does not change**.   * **0.843** rounded to the nearest hundredth is **0.84**   If the thousandths place is **five through nine**, the hundredths place is **increased by one**.   * **0.846** rounded to the nearest hundredth is **0.85**   **Rounding**  **To round numbers to the nearest hundred,** make the numbers that end in **1 through 49** into the next lower number that ends in 00. **For example 424 rounded to the nearest hundred would be 400.** Numbers that have the last two digits of 50 or more should be rounded up to the next even hundred. **988** rounded to the nearest hundred would be **1000.**  **To round numbers to the nearest thousand,** make the numbers whose last three digits are **001 through 499** into the next lower number that ends in 000. **For example, 6424** rounded to the nearest thousand is **6000.** Numbers that have the last three digits of 500 or more should be rounded up to the next even thousand.8788 rounded to the nearest thousand is **9000.**  **To round numbers to the nearest ten thousand**, make the numbers whose last four digits are **0001 through 4999** into the next lower number that ends in 0000. **So 54,424** rounded to the nearest ten thousand would **be 50,000.** Numbers that have the last four digits of 5000 or more should be rounded up to the next even ten thousand.  **78,988** rounded to the nearest ten thousand would be **80,000.**  **To round numbers to the nearest hundred thousand**, use the last five digits.  **Question:**  0.0056 is how many times smaller than 560,000?  100,000  1,000,000  **100,000,000**  1,000,000,000  Hundred Thousand 100,000  Million 1,000,000  Hundred Million 100,000,000  Billion 1,000,000,000  **Counting Zeros to Find Exponents**  **What expression is equal to 100,000,000?**  Count the number of "O"s behind the "1" and that is the exponent.  10,000,000 has 8 zeros So 100,000,000 = **108**  **Question:**  A farmer has a silo that can hold **240** bushels of corn. He estimates that it is about **6/7** full of corn. Which value is **closest** to the number of bushels of corn in the silo?  200  **210**  225  250  {**205** – so the number rounds UP to **210**.)  |Absolute Value|  Solve: (-|-43.5| ÷ -|12|) ÷ |-7|  -51.8  51.8  -5.18  **0.518**  The absolute value of any number is the positive form of that number. For example |-5| and |5| are both equal to 5. To solve:  (-|-43.5| ÷ -|12|) ÷ |-7|  (-43.5 / -12) / 7  3.625 / 7  = 0.518  It is a Prime Number when it can't be divided evenly by any number  (except 1 or itself). | | |

**Practice Test Questions**

**Test 3 Question 20**

s = ut + ½ at2 is a formula used in Physics.

Given that a = 2, u = 2 and s = 15, what are the possible values of t?

t = √5

t = 3 or 5

t = -3 or 5

t = 3 or -5

Substitute a = 2, u = 2 and s = 15 into the formula . . .

s = ut + ½ at2

15 = 2t + t2

t2 + 2t – 15 = 0

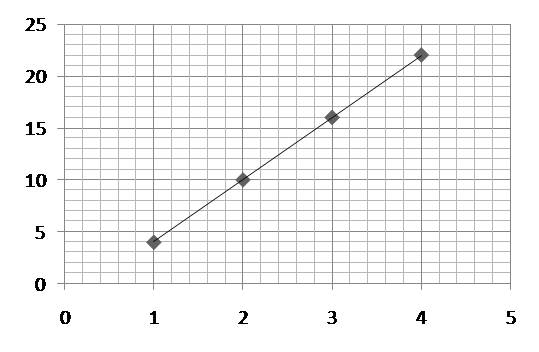
t2 + 5t – 3t – 15 = 0

t(t + 5) – 3(t + 5) = 0

(t – 3)(t + 5) = 0

t = 3 or -5

**Test 3 Question 5**



Which equation describes the line in the figure?

y = 6x + 2

**y = 6x - 2**

y = 2x + 6

6y = 2x + 1

Slope is the rise over run, meaning how far does the line go up the y axis for every unit of the x axis. Be careful to notice if the x and y axes cover different amounts of space as they do in this graph. The line increases by 6 on the y axis for every 1 on the x axis making m = 6.

Pick known points and use the equation for a straight line: y = mx + b

In the graph we see . . . when x = 2 that y = 10. Therefore,

y = m x + b

10 = 6\*2 + b

10 = 12 + b

10 - 12 = b = -2

Therefore the answer is y = 6x - 2

**Test 1 Question 12**

If f is defined by f(x) = x2 +3x – 2, what is f(x + ½)?

---------------------------------

Test 1 Q 22

Substitute **y = 2x + 1** into the expression **y2 – 2y – 3** and factorize your answer as much as possible.

4(x + 1)(x - 1)

4(x2 - x - 1)

2(x - 1)2

(2x - 4)(2x + 2)

--------------------------------------------------

y2 – 2y – 3 = (2x + 1)2 – 2(2x + 1) – 3

= (2x + 1) (2x + 1) – 2(2x + 1) – 3

= 4x2 + 2x + 2x + 1 – 4x – 2 – 3

= 4x2 – 4

= 4(x2 – 1) - the difference of two squares.

= 4(x + 1)(x – 1)

**Test 1 Question 37**

Jane is planning a wedding reception. She feels certain that 20% of the people she invites will not attend. If the banquet hall she is using can accommodate 120 people, how many people can she invite?

175

125

**150**

140

If **20%** **of the people Jane invites** will not attend, 80% will. If you use x to represent the number of people she invites, then 80% of x is 120. Convert 80% to a decimal by moving the decimal point two places to the left. 80% = 0.8. Now you can say 0.8x = 120. When you divide both sides of the equation by 0.8, you get x = 150.

**Test 1 Question 38**

The area of a circle is 100 square units.  Its circumference is:

20 units

20/√π units

20√π units

40/√π units

The formula for area and circumference of a circle are A = πr2  and C = 2πr

If A = 100 , then  πr2  = 100  
r2  = 100/π  
r = √(100/π)  
r = 10/√π

C =   
2 π r =   
2 \* π \* 10/√ π = 20 π / √π = 20√ π

**Test 1 Question 00**

The chances of drawing a J, Q, K or A from a deck of cards is 16/52. Which is the closest probability?

16%

**31%**

52%

25%

**Probability can be treated as any fraction.** Converting 16/52 into a percent is as simple as dividing 16 by 52 and multiplying by 100:

16/52 = 0.307

0.307 \* 100 = 30.7

Rounding gives 31%.

Volume of cube = length \* width \* height

1.Turn the second fraction (the one you want to divide by) upside-down (reciprocal).

Step 2. Multiply by that reciprocal

Step 3. Simplify

One root of the quadratic equation ax2 – 9x + 2 = 0 is 1/3.

**Test 16 Q24**

The volume, V, of a sphere varies directly with the cube of its radius, r3.

Given that V = 113.4 when r = 3, find the value of V when r = 2.

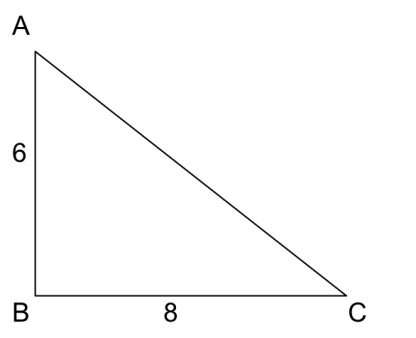
75.6

50.4

33.6

382.725

**Test 14 Q10**

****

If angle ABC is 90°, what is the value of AC?

12

14

10

8

In a right triangle, the side opposite the right angle is called the hypoteneuse. According to the **Pythagorean theorem**, the square of the hypoteneuse is equal to the sum of the squares of the other two sides.   a2 + b2 = c2

62 = 36 and 82 = 64. The sum of the squares of these two sides is 100, and 100 is equal to 102. So AC = 10

**Test 14 Q11**

**Test 14 Q15**

The children at Summer High travel to school in five different ways.

3/8 of them are taken there by car.

1/3 of them travel by bus.

2/9 of them arrive by bicycle

1/24 arrive by train.

The rest walk.

What fraction of the children walk?

7/44

**35/36**

1/36

1/18

**Test 14 Q20**

Divide 480 into three parts with a ratio of 1:2:3.

79, 184, 217

84, 102, 240

80, 160, 240

160, 240, 480

**Test 14 Q26**

The diagram shows the first three triangle numbers. The first three triangle numbers are 1, 3 and 6.

The eighth triangle number is:

8

24

28

36

The children at Summer High travel to school in five different ways.

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1/24 arrive by train.

The rest walk.

What fraction of the children walk?

7/44

35/36

1/36

1/18

**Test 13 Q2**

What is the other root?

9

1/9

2/3

-2/3

**Test 13 Q13**

What is the perimeter of the triangle?

12 units

**7 + √7 units**

7 - √7 units

1.5√7 units

Step 1 Use **Pythagoras’ Theorem** to find the length of the third side, c, of the triangle:

c2 + 32 = 42

⇒ c2 = 42 – 32 = 16 – 9 = 7

⇒c = √7

Step 2 Add the lengths of the sides of the triangle together to find the perimeter:

Perimeter = 3 + 4 + √7 = 7 + √7

**Test 13 Q33**

A rhombus is a parallelogram that has four equal sides. Which of the following geometric shapes must be a rhombus?

a square

an equilateral triangle

a right triangle

a rectangle

**Test 13 Q37**

What is 2/5 of 3/4?

3/8

7/16

3/10

7/15

To find 2/5 of 3/4, **multiply the two fractions**. You do this by multiplying the numerators by each other and the denominators by each other. 2/5 \* 3/4 = 6/20. You can simplify this fraction by dividing the numerator and the denominator by 2. 6/20 = 3/10.

**Test 13 Q46**

The width (not length) of a standard pencil is closest to which of the following?

One meter

One yard

One millimeter

One centimeter

**Test 12 Q7**

What is 30% of 1/6?

**1/20**

30% is the same as 30/100. You can reduce this fraction to 3/10. To find 30% of 1/6, multiply 3/10 \* 1/6. To multiply fractions, multiply the numerators by each other and the denominators by each other. 3/10 \* 1/6 = 3/60 . . . then reduce 3/60 to 1/20.

**Test 12 Q11**

A circle has an area of 50.24 square inches. What is the diamter of the circle?

If you know the area, you can find the radius by first dividing the area by π. 50.24 / π = 16. This is the radius squared. The square root of 16 is 4, so the radius is 4 inches. **But** the question asks about **diameter**, which is 8 inches.

**Test 11 Q50**

A line, L, is parallel to the line **3y + 2x = 6** and passes through the point (3, -1).

Find the point where L intersects the y-axis.

**(0, 1)**

(0, -5½)

(32/3, 0)

(0, 2)

Find the slope **m** by

A. Rearrange for y

**3y + 2x = 6**

**3y = -2x + 6**

B. Now isolate y

**3y = -2x + 6**

**3 = 3 3 or**

**Y = -2/3 + 2 so 2/3 is slope m**

C. Now determine B by plugging in the given points – listed here as y equals -1 and x = 3

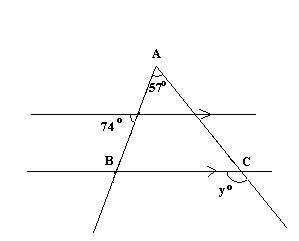
**-1 = -2/3(3) + B** ……… -1 = -2 + B so B must be 1 ………… -1 = -2 + 1

**1 = -2/3 (0) + 1**

**D.** Choose the best answer from the choices given, based on the slope formula.

1 = -2/3(0) + 1

**Test 11 Q 43**

****

The size of angle y° is:

107°

59°

121°

131°

Basically, add the two given angles and subtract from 180°. Here 57 + 74 =131, 180 – 131 = 49.

Note that the lines are parallel, as indicated by the "greater than" or arrow-like signs in each.

Consider the angles of triangle ABC:

BAC = 57°

ABC = 74° (alternate to the given angle)

ACB = 180° – (57° + 74° ) = 49°

Because they lie along the same line, angle ACB + angle y = 180°

y° = 180° – 49° = 131°

**Test 11 Q 12 – is there a secret to decimal placement?**

What does 2.37 X 104 equal?

23,700

0.237

0.00237

0.000237

**Test 10 Q 10**

The function f is defined by f(x) = (x + 1)2

For what value of **a** does f(a + 1/3) = f(a – 3) ?

0

3

1/3

-41/3

**f(a + 1/3) = f(a – 3)**

⇒ (a + 1/3 + 1)2 = (a – 3 + 1)2

⇒ (a + 4/3)2 = (a – 2)2

⇒ a2 + 8/3a + 16/9 = a2 – 4a + 4

⇒ 8/3a + 4a = 4 – 16/9

⇒ 8/3 a + 12/3a = 36/9 – 16/9

⇒ 20/3a = 20/9

⇒ a = 20/9 ÷ 20/3 = 20/9 \* 3/20 = 1/3

**Test 10 Q 11**

Approximately how many cubic inches of shaving cream can be packaged in a cylindrical container that is 6 inches tall and 2 inches in diameter?

5

12

14

19

**Test 10 Q 17**

The letters of the word MISSISSIPPI are written one on each of 11 cards and the cards are shuffled. The top card is turned face up and its letter noted. The card is replaced in the pack and the process repeated. What is the probability that both cards are S?

**16/121**

8/11

6/55

4/121

There are 11 cards altogether and 4 of them are S. So, the probability that the first card turned up will be an S = 4/11. Since the card is replaced, the probability that the second card turned up will be an S is also = 4/11

Therefore, the probability that both cards are S = (4/11)2 = 16/121

**Test 10 Q28**

All of the following are equivalent to 1/8 EXCEPT

0.125

8 \* 10-1

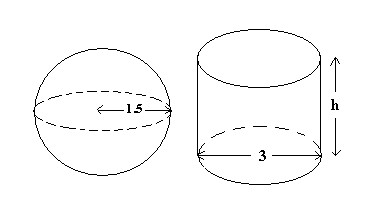
8-1

1/2 \* 1/4

8 \* 10-1 is 8 \* 1/10, or 8/10.

Any number to the **power of -1 is equal to 1 divided by the number.** 10-1 is 1/10.

**Test 10 Q29**



The first diagram shows a piece of modeling clay which is spherical in shape and has a volume of 4.5π cubic inches. The clay is remodeled into the shape of a cylinder with a diameter of 3 inches.

Find the height, h, of the cylinder.

4 inches

2 inches

1.5 inches

2π inches

**Test 10 Q44**

Which of the following is equivalent to (4/ab) / (b/2) if ab ≠ 0?

4b / 2ab

ab2 / 8

2ab2 / b

**8/ab2**

**To divide by a fraction, invert the fraction and multiply.** Multiply 4/ab by 2/b.

**Two triangles question**

**Test 9 Q**

**Test 9 Q23**

What is the approximate increase in the price of Supercorp's stock from week 1 **ro** week 4?

**Test 9 Q24**

A train took 5 minutes to travel between two stations that were 4 miles apart. What was the average speed of the train?

48 mph

40 mph

30 mph

54 mph

r = d / t

t = d / r

d = r \* t

**Test 9 Q25**

The population of a city grew from 750,000 to 1.2 million in 25 years.

By what percent did the population grow over that time?

45%

37½%

60%

2.4%

**Test 9 Q28**

The sum of two numbers is equal to 28 and their difference is less than 12. What can you deduce about the two numbers?

One is greater than 20 and the other is greater than 8.

One is less than 20 and the other is greater than 8.

They are both less than 12.

One is less than 12 and the other is greater than 12.

**Test 9 Q29**

What is the product of 1/3, 1/4, and 4/5?

2/3

1/60

**1/15**

1/10

**Test 9 Q31**

Solve the equation: 5y – ( 2y – 3 ) = 6

4y + ( 3y – 7 ) 7

3

2

-1

36/35

Step 1: Simplify the numerator and denominator of the left hand side.

⇒ 3y + 3 = 6

7y - 7 7

Step 2: Cross multiply.

⇒ 7(3y + 3) = 6( 7y – 7)

Step 3: Multiply out the parentheses on both sides.

⇒ 21y + 21 = 42y – 42

Step 4: Rearrange and solve.

⇒ 21 + 42 = 42y – 21y

⇒ 21y = 63

⇒ y = 3

**Test 9 Q32 ?**

**Test 9 Q33**

What percent of 200 is 500?

300

250

200

150

**When a question asks, what percent of a is b, divide b by a.**

**Test 9 Q35**

Bob purchased a shirt, a tie, and a sport coat. The shirt cost $5 more than the tie, and the sport cost cost 5 times as much as the shirt. He spent $205 altogether. How much did he pay for the tie?

$30

$25

$24

$20

**Test 9 Q 39**

Some sharks are huge. No sharks are minnows. No minnows eat sharks. Therefore,

All sharks eat minnows.

No minnows are sharks.

No minnows eat sharks.

No minnows are huge.

**Test 9 Q 43**

A man flipped a coin four times and got "heads" each time. What is the probability that he will get "heads" on the fifth time he flips the coin?

20%

25%

50%

More than 50% but less than 80%

**Test 9 Q 44**

The formula for the surface area of a cone is A = pr(r + s)

Find s if A =88, p = 22/7 and r = 4

10

3

4

7

**Test 9 Q 45**

The diagram shows a plan view of a 400m running track.

Using 22/7 as an approximation for p, the area enclosed within the running track is:

7859.25 m2

9418.5 m2

18774 m2

12537 m2

**Test 9 Q 4**

Roy cycles up a hill on a road 12 miles long at an average speed of 8 miles per hour. He then cycles down the same road at an average speed of 24 miles per hour.

What is his average speed for the whole journey?

10 mph

102/7 mph

6 mph

12 mph

**Test 8 Q 42**

The function f is defined by f(x) = (x –1)1/2 for values of x ≥ 1

For what value or values of x is f(x) = 4 ?

±√3

**17**

15

1

Given is thatf(x) = 4   
  
(x –1)1/2  = 4  
Square both sides:

       x – 1 = 42   
       x – 1 = 16

x = 17

**Test 8 Q 44**

For a series, the term xn is given by the formula

xn = 3xn – 1 - 2xn – 2 for all n ≥ 2

If x0 = 1 and x1 = 5, what is the value of x3 ?

37

-11

13

29

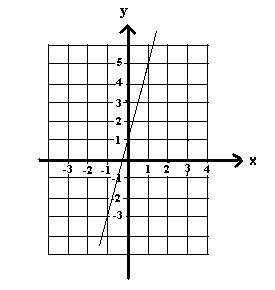
Before you can find x3 , firstly find x2

x2 = 3x1 - 2x0 = 3 \*5 – 2 \* 1 = 15 – 2 = 13

Now use the formula a second time to find x3

x3 = 3x2 - 2x1 = 3 \*13 – 2 \* 5 = 39 – 10 = 29

**Test 8 Q 45**

****

Find the **equation of the straight line** that is parallel to the line in the diagram and passes through the point (½, -1).

y = 4x + 1

**y = 4x – 3**

y = ¼x – 9/8

y = -¼x – 7/8

The given line passes through (0,1) and (1,5)

Its slope is (5 – 1)/(1 – 0) = 4

Any line parallel to the given line also has slope equal to 4.

We need to find the equation of the line through (½, -1) with slope 4.

Using y – y1 = m(x – x1) ⇒ y – (-1) = 4(x - ½)

⇒ y + 1 = 4x – 2

⇒ y = 4x – 3

**Test 8 Q 28**

Karen's truck has a carrying capacity of two tons. How many trips will she have to make if she has to deliver 14,000 lbs of top soil?

3

**4**

6

7

Karen's truck can carry 2 tons, and **one ton** **=** **2,000 pounds**, so her truck can carry 4,000 pounds total. If you divide 14,000 by 4,000, you get 3.5.

14,000 / 4,000 = 3.5

**13**

If -2( x – 3 ) = 3( y + 5 ) – 10 , express y in terms of x.

|  |  |  |
| --- | --- | --- |
| Description: https://www.examedge.com/images/symbol_correct.jpg |  | y = -2x + 1  3 |
|  |  | y = -2x + 8  3 |
|  |  | y = -2x - 2  3 |
| Description: https://www.examedge.com/images/symbol_incorrect.gif |  | y = 2x - 11  3 |

First multiply out the brackets, remembering that -2 \* -3 = +6, then simplify both sides.

-2( x – 3 ) = 3( y + 5 ) – 10

⇒ -2x + 6 = 3y + 15 – 10

⇒ -2x + 6 = 3y + 5

⇒ 3y + 5 = -2x + 6

Next subtract 5 from both sides of the equation, then simplify the numbers.

⇒ 3y + 5 – 5 = -2x + 6 – 5

⇒ 3y = -2x + 1

Finally divide both sides of the equation by 5.

⇒ y = -2x + 1

3

**Test 8 Q 4**

|  |
| --- |
| The symbol ∂ is defined by:   a ∂ b = a2 – 3b2    If  x ∂ y = 2(y ∂ x),  express y in terms of x. |

|  |  |
| --- | --- |
|  | [y = 7/5x](javascript:click(0)) |
|  | [y = ±√(7/5)x](javascript:click(1)) |
|  | [y = ±√(4/5)x](javascript:click(2)) |
|  | [y = √[(x -3)/2] + 3](javascript:click(3)) |

**Test 7 Q 7**

Evaluate (3 \* 9)2/3 – 641/2 \* 5 + (72 / 9)1/3

The Correct answer is:  
**-29**   
  
The order of operations is summarized by **PEMDAS**.

**Step 1** Simplify numbers inside the **P**arentheses:

(3 \* 9)2/3  – 641/2 \* 5 + (72 / 9)1/3 = (27)2/3  – 641/2 \* 5 + (8)1/3

**Step 2** Work out **E**xponents:

(27)2/3  – 641/2 \* 5 + (8)1/3 = 9 – 8 \* 5 + 2

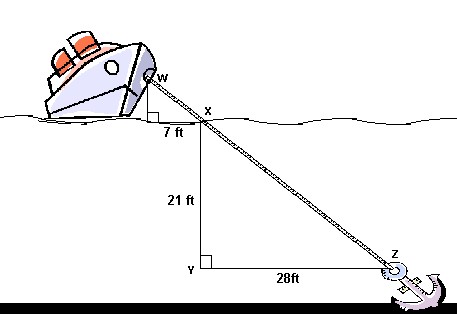
**Step 3** Do **M**ultiplication and **D**ivision in the order in which they occur. (Multiplication and division have the same rank in priority for order of operations.)

9 – 8 \* 5 + 2 = 9 – 40 + 2

**Step 4** Do **A**ddition and **S**ubtraction in the order in which they occur. (Addition and subtraction have the same rank in priority for order of operations.)

9 – 40 + 2 = -31 + 2 = -29

**Test 7 Q 12**



Calculate the length of the cable, WZ.

35 ft

**43.75 ft**

56 ft

31.25 ft

Step 1 Use the **Theorem of Pythagoras** to find the length XZ. Represent this by y ft:

\ y2 = 282 + 212

= 784 + 441

= 1,225

\ y = √1,225

= 35

\XZ = 35 ft

Step 2 Use similar triangles to find the length WX:

WX/7 = ZX/28 = 35ft/28

\ WX = 7 \* 35ft/28 = 8.75 ft

\ WZ = WX + XZ = 35 ft + 8.75 ft = 43.75 ft

**Test 7 Q 28**

**If x + 3 > y +5, then**

x < y

x = y

x is a negative number

**x > y**

If you subtract 3 from both sides of the equation, you get x > y + 2.

In other words, x is at least 2 more than y.

**Test 7 Q 35**

The freezing point of water is 0° on the Celsius scale and 32° on the Fahrenheit scale. The boiling point of water is 100° on the Celsius scale and 212° on the Fahrenheit scale. Approximately what number on the Fahrenheit scale would be equivalent to 50° on the Celsius scale?

**122°**

100°

80°

110°

50° is the midpoint between freezing and boiling on the Celsius scale. To find the midpoint on the Fahrenheit scale, subtract 32° from 212° and divivde by 2. 212 - 32 = 180. 180/2 = 90. Now add 90° to 32° or subtract 90° from 212° to find the midpoint on the scale.

**Test 7 Q 38**

The marathon is a long-distance running event over a distance of 26 miles 385 yards. The world record time for men over the distance is 2 hours 5 minutes, held by Haile Gebrselassie of Ethiopia. The world record for women of 2 hours 15 minutes is held by Paula Radcliffe of Great Britain.

The ratio of Gebrselassie’s time to Radcliffe’s time is:

5:43

**25:27**

21:23

13:15

Gebrselassie’s time = (2 \* 60 + 5) minutes = 125 minutes

Radcliffe’s time is = (2 \* 60 + 15) minutes = 135 minutes

Ratio of times = 125:135 = **25:27**

**Test 7 Q 40**

What values of a satisfy the equation: 21/a – 10a = 1

a = 1.4 only

a = 1.4 or -1.5

a = -1.4 or 1.5

a = 1/11

21/a – 10a = 1

**Step 1** Multiply all terms by a:

\21 – 10a2  = a

**Step 2** Move all terms to one side of the equation:

\0 = a – 21 + 10a2

(Note that this is a quadratic equation with two distinct roots)

**Step 3** Rearrange

\10a2 + a – 21 = 0

**Step 4** Factorize

\10a2 – 14a + 15a – 21 = 0

\2a (5a – 7) + 3 (5a –7) = 0

\(2a + 3 )( 5a – 7 ) = 0

\ a = -1.5 or 1.4

(Note that we may have guessed that either C or D would be correct once we established that the original equation leads to a quadratic equation with two distinct roots.)

**Test 7 Q 41**

Ten percent of a **one pound** package of frozen shrimp is ice. How much ice is there in a one pound package of frozen shrimp?

**1.6 ounces**

1 ounce

0.6 ounces

0.5 ounces

**Test 4 Q 43**

Solve: ( |-36| \* -|5|) ÷ -|15|

-12

-7.2

12

7.2

**Test 4/Q** ?

Change 12/13 to a percent.

92.3%

0.923%

0.0923%

93%

**Test 4/Q** 20

If j + 10 = k - 10, then

j > k

j = k/1

j = k

**j < k**

If you subtract 10 from both sides of the equation, you get j = k - 20.

So j is less than k.

**Test 4/Q 32**

Solve: (-|-43.5| ÷ -|12|) ÷ |-7|

-51.8

51.8

-5.18

0.518

**Test 4/Q** 33

A school bus takes a soccer team to a high school 12 miles away. If the bus travels at an average speed of 30 mph, how long will it take to get to the high school?

20 minutes

24 minutes

26 minutes

40 minutes

**Test 4/Q** 35

0.0056 is how many times smaller than 560,000?

100,000

1,000,000

100,000,000

1,000,000,000

# Test 4/Q 36

# Express 10(x + 1)2 – (x + 1) – 3 as the product of two factors.

# (x + 1)[ 10(x + 1) – 1] – 3 (5x + 3)(2x – 1) (5x – 2)(2x – 3) (5x + 2)(2x + 3)

Explanation:

Let y = x + 1

10(x + 1)2 – (x + 1) – 3 = 10y2 – y – 3

= 10y2 + 5y – 6y – 3

= 5y(2y + 1) – 3(2y + 1)

= (5y – 3)(2y + 1)

= [5(x + 1) – 3][2(x + 1) +1]

= (5x + 2)(2x + 3)

**Test 4/Q** 40.

Find the equation of the straight line perpendicular to the line y = -1/3x + 5 and passing through the point (-2,4)

y = 1/3x + 14/3

y = -3x -2

y = 3x - 2

**y = 3x + 10**

|  |
| --- |
| **Explanation:** |
| **Step 1** Find the slope of the given line.  For an equation of the form y = mx + c, the slope is m.  ∴The slope of the line y = -1/3x + 5 is **-1/3**    **Step 2** Find the slope of a line perpendicular to the given line.  If the slopes of perpendicular lines are m1 and m2 , then m1\*m2 = -1  Since -1/3 \* 3 = -1, the slope of any line perpendicular to the given line must be **3**    **Step 3** Find the equation of the line with slope 3 and passing through (-2,4)  Use the formula y – y1 = m(x – x1) with m = 3, x1 = -2 and  y1 = 4  ∴y – 4 = 3(x – (-2)) = 3(x + 2) = 3x + 6 ⇒ **y = 3x + 10** |

# Test 4/Q 41

# Solve for x:

# 5x + 3 ≥ 4x - 6

# x ≥ -3 x ≤ -9 x ≥ -9 x = -9

Inequalities can be treated as equations – unless you are multiplying or dividing a negative number. In this case we can simply think of the inequality as an equation.

5x + 3 ≥ 4x - 6

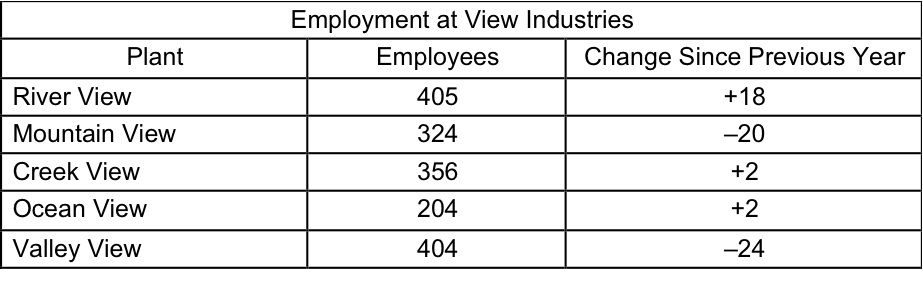
Subtract 4x from both sides:

x + 3 ≥ -6

Then subtract 3 from both sides:

**x ≥ -9**

# Test 4 /Q. 50

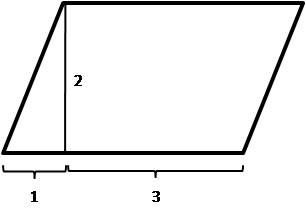


First calculate the number of employees the previous year by adding or subtracting the change since the previous year. Then divide the amount of the change by the previous year's employment. For example, for the Mountain View plant, you find that employment in the previous year was 344. Divide the change, -20, by 344. You get -0.0058. Convert this decimal to -5.8% by moving the decimal point two places to the left.

# Using the same process, you get 4.7% for the River View plant and -5.6% for the Valley View plant.

# Misleading question example:

# What is the area of the parallelogram?



# 6 8 12 6 + √2

**How do I calculate percentage change?**

When a question asks, what percent of a is b, divide b by a.

**How do I calculate speed (rate, distance, mph)?**

Rate = distance / time

# Knowledgebase Immersion Standards – Full Syllabus

#### I. Understand the principles of geometry (0015)

1. analyzing polygons using attributes of sides, angles, and parallel and perpendicular lines
2. analyzing three-dimensional figures using attributes of faces, edges, and vertices
3. applying geometrical transformations (e.g., translations, reflections, rotations) to geometric figures and using the concepts of symmetry, similarity, and congruence to solve problems
4. using coordinate geometry to analyze geometric figures
5. using algebraic methods (e.g., Pythagorean theorem, coordinate geometry) to solve mathematical and real-world problems
6. analyzing arguments and justifying conclusions based on geometric concepts

#### II. Apply principles of algebra to expressions and equations (0012)

1. analyzing and extending a variety of patterns
2. using the concepts of variable, equality, and equation to generate, interpret, and evaluate algebraic expressions based on verbal descriptions
3. manipulating algebraic expressions and solving equations using a variety of techniques (e.g., performing operations, simplifying, factoring)
4. applying algebraic principles to represent and solve word problems involving fractions, ratios, proportions, and percents

#### III. Apply principles of algebra to linear and nonlinear functions (0013)

1. distinguishing between relations and functions
2. translating between different representations (e.g., tables, verbal descriptions, equations, graphs) of linear and nonlinear functions
3. relating the characteristics of a linear equation (e.g., slope, intercepts) to its graph
4. selecting a linear equation that best models a real-world situation, and interpreting the slope and intercepts in the context of the problem
5. selecting a nonlinear function that best models a real-world situation
6. solving linear equations, systems of linear equations, and inequalities symbolically and graphically
7. analyzing the graph of a nonlinear function (e.g., quadratic, rational, exponential)

#### IV. Understand measurement concepts (0014)

1. estimating and calculating measurements using metric, customary, and nonstandard units, unit conversions, and dimensional analysis in real-world situations
2. applying formulas to calculate perimeter, circumference, length, area, surface area, volume, and angles for two- and three-dimensional figures in mathematical and real-world situations
3. estimating and calculating measurements indirectly using the Pythagorean theorem, ratios, proportions, and the principles of similarity and congruence
4. determining how the characteristics of geometric figures (e.g., area, volume) are affected by changes in their dimensions
5. solving a variety of measurement problems (e.g., time, temperature, rates of change)

#### V. Demonstrate knowledge of data, statistics, probability and discrete mathematics (0016)

1. using measures of central tendency (e.g., mean, median) and spread (e.g., range) to draw conclusions and make predictions from data
2. selecting appropriate ways to display data and statistical information (e.g., tables, circle graphs, histograms)
3. analyzing and drawing inferences from data presented in different formats (e.g., frequency distributions, percentiles, graphs)
4. calculating probabilities for simple, compound, independent, dependent, and conditional events described in various ways (e.g., word problems, tree diagrams, Venn diagrams)
5. identifying real-world applications of topics in discrete mathematics (e.g., graph theory, combinatorics, algorithms, iteration)

#### VI. Understand mathematical processes and perspectives (0017)

1. selecting an appropriate problem-solving strategy for a situation (e.g., estimation, drawing a picture, working backward, using manipulatives)
2. using mathematical reasoning and principles of logic to evaluate arguments (e.g., distinguishing between inductive and deductive reasoning, applying principles of logic, using counterexamples, evaluating informal proofs) and determining the reasonableness of solutions to problems
3. translating between verbal descriptions and mathematical language, notation, and symbols (e.g., function notation, set notation, order relations)
4. identifying connections between mathematical concepts, other academic disciplines, and technology

#### VII. Understand numbers and the number system (0011)

1. demonstrating knowledge of the properties of integers, rational and real numbers, and number operations
2. demonstrating fluency in computation, including operations on decimals, percents, fractions, and exponents
3. using number sense and different number representations to solve mathematical and real-world problems