Quantitative Reasoning Test 3: 30 Questions with answers & explanation.

Directions: All numbers are real numbers. Do not use a calculator, but scratch paper is allowed. There are four or five answer choices for each question. Answer each question before moving on (don't leave anything blank). For each question, indicate the best answer, using the directions given

Question 1-13 have several different format- multiple choice questions and numeric entry questions. Unless directed select a single answer choice

1. The area of the space bounded by the x and y axes and between the lines described by the equations y = -2x + 10 and y = -2x + 2, in square units, is

A 1
B 4
C 10
D 24
E 25

2. $12r^2 - 51r + 45 =$

A 3(4r -5)(r+3)
B 3(4r+5)(r-3)
C 3(4r+3)(r-5)
D 3(4r-5)(r-3)
E $3r^2 - 15$

3. If the number of seconds in *d* days equals the number of minutes in 8 weeks, then *d* =

A 60

B 56
C 7
D 2/5
E 14/15

4. If $y = \frac{29}{31}$ and $x = 43$, then $\frac{y^0 \cdot y^1 \cdot y^2 \cdot x}{xy^3} =$

A 0
B 1
C x
D $\frac{1}{y}$
E $\frac{29}{31}$

5. If $x^2 - 4x = 45$, then x =

I 9
II 8
III -5

A I only
B II only
C III only
D II or III only
E I or III only

6. If y is a positive integer, and x = y(5)(6)(7)(8), then x is evenly divisible by

I 12
II 25
III 15

A I only
B II only
C II and III only
D I and III only

E I, II, and III

7. For what value of x is it true that $0.2x = 3.3 - 0.5y$ and $0.6y = 0.2x + 2.2$?

A 0.4
B 0.5
C 4
D 5
E 20

8. A triangle ABC drawn on the coordinate plane has one side determined by points A = (1,3) and B = (5,6). The slope of the line BC is −3, while the slope of the line AC = 0. The coordinates of point C are

A (4,6)
B (1,18)
C (3,7)
D (6,3)
E (1,6)

9. The product of the greatest prime factor of 88 and the smallest prime factor of 117 is

A 6
B 33
C 99
D 104
E 858

10. 30 liters of a solution of water and acid contains 15% acid. If more water is added to change the solution to 5% acid, which of the following represents the number of liters of water in the final solution?

A 30
B 57
C 60

D 85.5
E 90

11. Anna bought a collectible statuette at an auction for 40% above the starting bid of $200. Then an appraiser told her that it was worth 15% less than she had paid. The statuette is worth

A $42
B $238
C $250
D $265
E $330

12. Point A on the coordinate plane is 24 units from point B and 48 units from point C. Set N= {all possible distances from B to C}. The range of set N =

A 12
B 24
C 32
D 48
E 72

13. In a certain geometric sequence, the first five terms are *m, n, o, p,* and *q.* If m = ½ and o = 18, the fifth term in the series is

A 6
B 9
C 18
D 108
E 648

Direction: For each of question, 14-30, compare column A and Column B and select one of the following 4 answer choices of the question.

- **The quantity in Column A is greater.**
- **The quantity in Column B is greater.**

- **The two quantities are equal.**
- **The relationship cannot be determined from the information given.**

14. A restaurant serves 16 different items; the lunch “custom meal” offer includes the diner’s choice of any 3 different dishes. How many different meals can be created?

Column A 16x15x14

Column B 16!/13!

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

15. A right triangle ABC has hypotenuse 20 and base 16.

Column A: The area of triangle ABC

Column B: Two times the perimeter of triangle ABC

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

16. Peter left home and drove toward the family vacation house at an average speed of 40 km/hour. Sophia left home some time later and, driving at 48 km/hr for five hours, caught up with Peter. At that time Peter had been driving for *h* hours.

Column A 336 km

Column B The distance Sophia could drive in *h* hours at her current speed

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

17. The number n is an integer, $7^n < 3000$, and $5^n > 600$.

Column A: 5

Column B: n

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

18.
Column A: Number of square tiles needed to cover a space on a wall of 72” x 108”, using tiles that each have a perimeter of 36 inches.

Column B: Number of square tiles needed to make a rectangular border one tile wide around the outside of the same 72” x 108” space, using tiles that each have an area of 9 square inches.

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

19. A girl sells cups of lemonade at a stand. Her sales on Wednesday compared to Tuesday were in the ratio 3:2. If she had sold 80 more cups of lemonade on Tuesday, she would have sold the same number of cups on each day.

Column A: The number of cups of lemonade she sold on Tuesday

Column B: Twice the number of additional cups needed on Tuesday to match Wednesday's sales

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

20. Jack and Joe are specialty repair contractors who work on a daily rate. Jack can earn $800 in 4 working days, while Joe takes 36 working days to earn $7200.

Column A: The total amount of money Jack and Joe earn if Joe works for 108 working days and Jack works for 72 working days

Column B: The total amount of money Joe and Jack earn if Jack works for 108 working days and Joe works for 72 working days

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

21.

Column A: 200 times larger than 0.063

Column B: 30 times larger than 0.42

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

22. m♥n = $n^2/(n-2m)$

Column A: 3♥-2

Column B: -2♥3

23. $x^2 - x - 20 = 0$

Column A: x

Column B: 5

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

24.

Column A: $\sqrt[3]{64y^3(xy)^6}$

Column B: $\sqrt{16y^2(xy)^4}$

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.

D The relationship cannot be determined from the information given.

25. Jessie looks in her closet to pick one of her 30 shirts to wear. She has 6 green shirts, 4 blue shirts, 2 red shirts, 10 yellow shirts, 1 white shirt, and the rest are other colors. 16 of the shirts are woven; the others are knit.

Column A minimum number of woven shirts that are not green or yellow

Column B number of knit shirts that are a color other than red, yellow, or white

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

26. Andy and Brandon are outside on a sunny late afternoon. Andy, who is 1.6m tall, casts a 400cm shadow, while Brandon's shadow is 300cm.

Column A twice Brandon's height

Column B The absolute value of the difference between the length of Andy's shadow and Andy's height

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

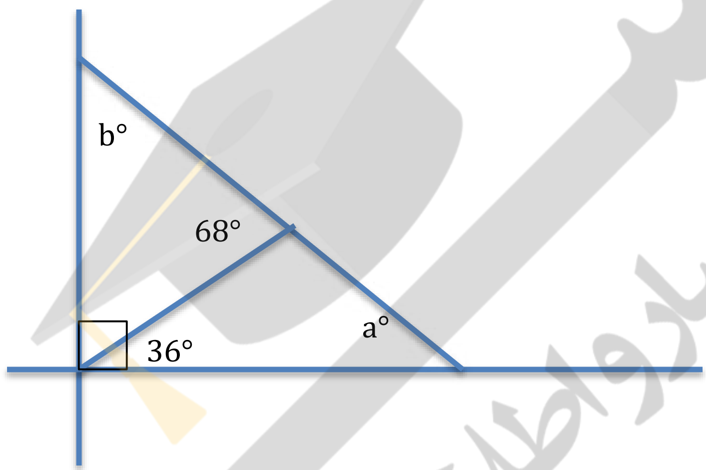
27.

Column A: The greatest common factor of 36, 54, and 90

Column B: least common multiple of 18, 3, and 6

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

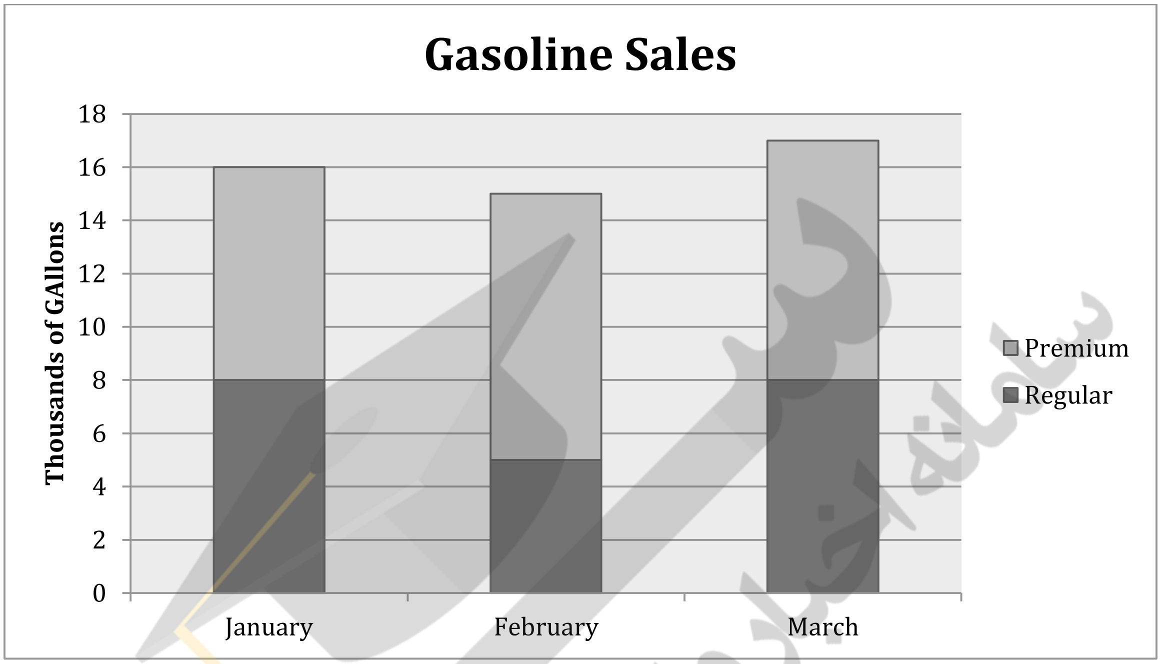
28.



The values for a and b are:

A 32, 58
B 36, 54
C 36, 68
D 54, 32

29 . (Refer to chart "Gasoline Sales")

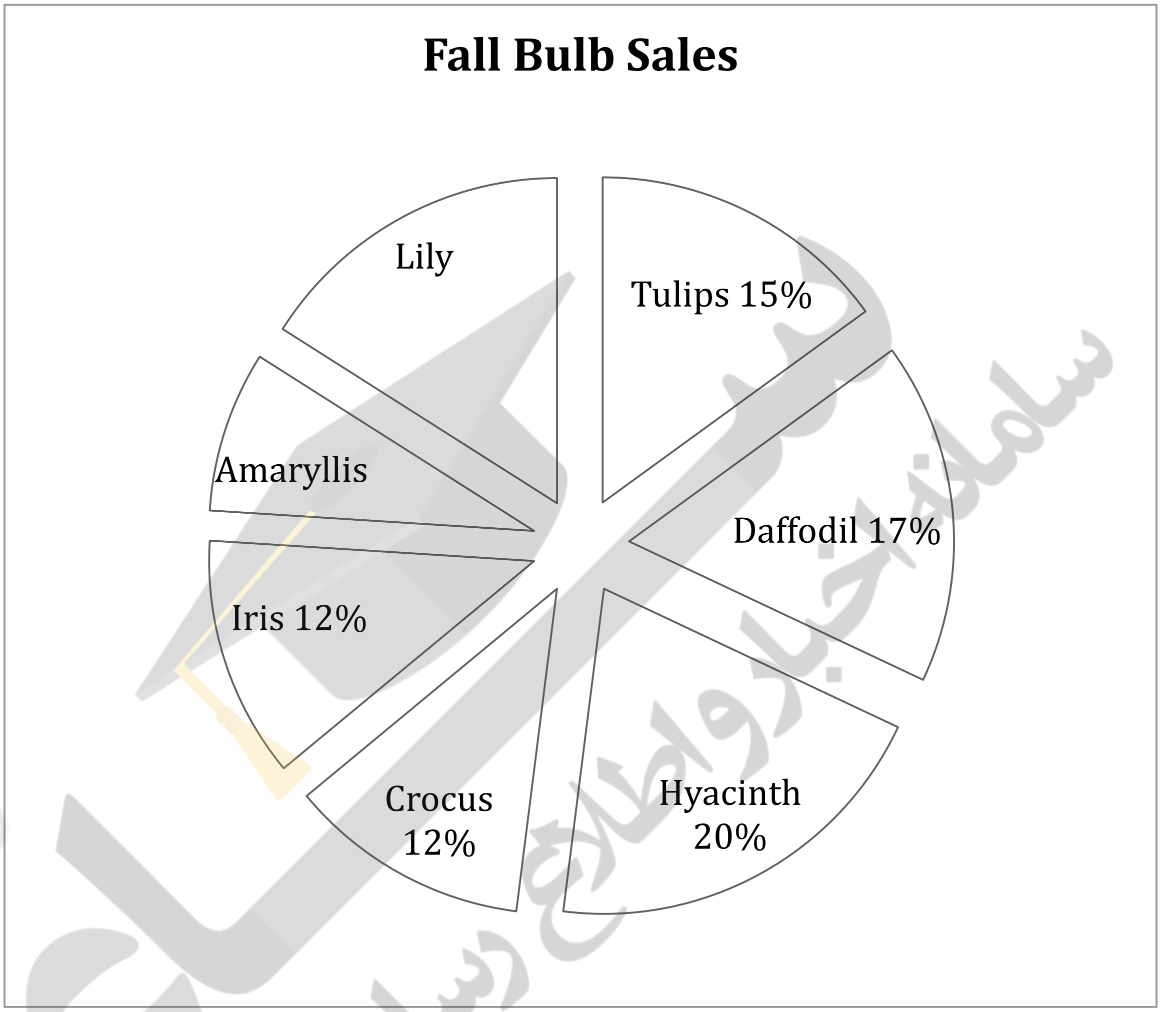


Column A: The percent change in premium sales from February to March

Column B: The percent change in total sales January to February

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal.
D The relationship cannot be determined from the information given.

30.



A garden store sells fall bulbs. There were twice as many lily bulbs as amaryllis bulbs sold. If 700 bulbs total were sold, how many lily bulbs were sold?

A 56
B 84
C 112
D 168
E 532

Answers & explanation

1. Answer: D.

Explanation: These two equations are in slope-intercept form; note that the lines have the same slope (they are parallel) with different intercepts. Make a quick sketch for yourself on your scratch paper -- place the two y-intercept points (0,2) and (0,10) and the two x-intercept points (5,0) and (1,0) found by making y=0. Connect the points; you should have two parallel lines that slope from the upper left down to the lower right. Each line forms a triangle with the x and y axes. The area between the lines is the area of the larger triangle minus the area of the smaller triangle. The formula for the area of a triangle is ½(bh). For the larger triangle, this is ½(5)(10) = 25; for the smaller, ½ (1)(2) = 1. Subtracting gives an area of 24.

2. Answer: D

Explanation: This looks gnarly, but use your test-taking skills before your algebra skills – glance ahead at the answer choices before you factor. You should be able to eliminate choice E, since it has no “r” term. The other four choices all pull the factor 3 out, so that gives you a head start; rewrite the equation as $3(4r^2 – 17r + 15)$. You will be using FOIL (Firsts, Outsides, Insides, Lasts) to factor further. If you think of it, a quick survey of the remaining choices shows that choice D is the only one whose “L” calculation could result in +15; pick it and you’re done. If you miss this, continue by noting that the remaining choices all have 4r and r as the first, or “F”, terms in the parentheses, and that the second choices are all +/- 3 and +/ 5, more useful clues. Set up your parentheses with what you already know: 3(4r __ __)(r___ ___). Now look for the combination of “O” and “I” pairs that add to -17r. This is only true for choice D: (4r)(-3) + (-5)(r) = -12r – 5r = -17r.

3. Answer: E.

Explanation: Set up the equality: (d days)(24 hrs/day)(60 min/hr)(60 sec/min) = (8 weeks)(7 days/week)(24 hours/day)(60 min/hr). Note that the 24 hr/day and the 60 min/hr appear on both sides of the equation, so they cancel. This leaves (ignoring the cleared units): d(60)

= 56. Solve for d and reduce to simplest terms. By the way, 14/15 of a day isn't as weird as it sounds; it's 22 hours and 24 minutes.

4. Answer: B.

Explanation: Anything taken to the 0 power is 1. The $y^1 \cdot y^2$ term cancels against the y^3, and the x's cancel.

5. Answer: E.

Explanation: A little tricky, this one. Algebra pros will get right to work factoring, but if plug-and-chuggers are clever, they might get the answer just as fast. If you are a factoring person, bring the 45 over to the left hand side of the equation: $x^2 - 4x - 45 = 0$. Set up your parentheses, and find $(x + 5)(x-9) = 0$. Thus, there are two solutions, $x = -5$, or $x = 9$. If you choose to plug in answer possibilities, don't stop with I, which works. Note that this fact eliminates choices B, C, and D, so don't bother checking the 8 in II. Check the -5 in III, find that it works, and pick choice E.

6. Answer: D.

Explanation: x must be divisible not only by the numbers listed as its factors along with y, but also by the factors of those numbers if they are not prime. So, x must be divisible by 2, 3, 4, 5, 6, 7, and 8, and by products of two or more distinct numbers from the list – but NOT by the product of any of the numbers by itself. So x is divisible by 3x4 = 12, and by 3x5 = 15, but not by 5*5=25.

7. Answer: C.

Explanation: These are two equations in two unknowns, conveniently with the same x-term in each. Solve the second equation for the x-term, set it equal to the first equation. This is easier on the eyes if you multiply everything through by 10 first: 33-5y = 6y-22, so 55 = 11y and 5 = y. Don't pick answer choice D; the question asks about x. Plug the y back in to either equation to find x = 4.

8. Answer: D.

Explanation: Draw yourself a sketch, including reasonably neat grid lines. Place and connect points A and B. Next, draw a line with slope -3 through point B (slope = rise over run; so for a slope of -3, for every one unit of x to the right, y goes down 3.) Now draw line AC with 0 slope (straight across). They intersect at point C, (6,3). If you thought a slope of 0 means a vertical line up from point A, erroneous choice B awaits you.

9. Answer: B.

Explanation: Factor each number down to its component primes. For example, 88 = 2(44) = 2(4)(11) = 2(2)(2)(11) = 2^3(11). Similarly, 117 = 3(39) = 3(3)(13) = 3^2(13). So, 11(3) = 33.

10. Answer: D.

Explanation: The equation of the mixture problem is 30(0.15) + x(0) = (30+x)(0.05). Multiplying the right hand side through and rearranging gives 0.05x + 1.5. Solve for x, the amount of water added, you get x=60, a number which awaits the unwary in choice C. But the question asks how much water is in the final solution, which is 95% of the 30 original liters plus the 60 liters just added.

11. Answer: B.

Explanation: You can't just subtract the 15% from the 40% and then multiply $200 by 125%. You must first find what she paid, and <u>then</u> take 85% (100%-15%) of that. So she paid $200(1.40) = $280, but the statuette was only worth 0.85($280) = $238.

12. Answer: D.

Explanation: The range of a set is its maximum value minus its minimum value. The maximum and minimum values for the distances occur when points A, B, and C lie on a line. If A is the middle point, then the distance between B and C is 48+24=72. If B is in the middle, then the distance between B and C is 48-24=24. So the range is 72-24=48.

13. Answer: E.

Explanation: In a geometric sequence, each term is the previous one multiplied by a constant. The constant (let's use k) can also be expressed as any term divided by the previous term; in this case, k=n/m = 2n. So o = kn = $2n^2$= 18, so $n = \sqrt{\frac{18}{2}} = 3$. Now we can say k=6, so o = 18. So p = ko = 6(18) = 108, and q = kp = 6(108) = 648.

14. Answer: C.

Explanation: The diner has 16 choices for the first item, then 15 once that has been chosen, then 14 for the third once the second has been picked. Therefore there are 16x15x14 possible combinations, choice A. But wait – look at Column B as well. 16!/13! may be written as (16x15x14x13x12x11…) / (13x12x11 …) Note that 13/13 cancels to 1, 12/12 cancels, etc. So the expression in Column B is equivalent to the expression in Column A. So the answer is choice C. Tricky.

15. Answer: C

Explanation: Fun fact: the areas and perimeters of triangles with legs 12 and 5 or 6 and 8 (talking whole numbers here) are equal. This triangle has a related relationship; its legs are twice as long as 6 and 8, and its area is equal to twice its perimeter. But you don't need to know all that for this problem. Just use the Pythagorean Theorem to find the height of the triangle: $16^2 + h^2 = 20^2$, so $h^2 = 144$, so h = 12. (Note that knowing higher squares off the top of your head is useful.) So the area of the triangle = ½ bh = ½ (16)(12) = 96, and twice the perimeter is 2(20 + 16 + 12) = 96.

16. Answer: A

Explanation: One way to handle distance-rate-time problems is to ask yourself "What equals what?" In this case, it is the distance Peter has driven and the distance Sophia has driven at the time they meet up. The expression for Peter's distance = (40)(h), and for Sophia it is (48)(5). Solve for h = (48)(5)/(40); save yourself calculation time by pulling the factor 8 out from the numerator and the denominator, leaving (6)(5)/(5); now the 5's cancel, leaving the 6 (ain't factoring wonderful?) Now, the distance Sophia could drive in 6 hours at 48 km/hr = (6)(48) = 288 km.

17. Answer: A

Explanation: The best approach for this problem is to "plug and chug". Remember that the number must work for both equations. Since it is easier to do powers of 5 than of 7, start there and see if we can narrow things down a bit. You know from the second equation that n will be positive. Let's start with n=2. You know that 5 x 5 = 25, and 25 x 5 = 125; 125 x 5 is the same as half of 125 x 10, so 1250/2 = 625. So, n has to be at least 4 in order for 5^n to be greater than 600. Now let's look at the powers of 7, but save yourself scratch paper time by estimating. Since we know that n has to be at least 4, let's find 7^4 and go from there: 7 x 7 = 49; 49 x 7 is almost like 50 x 7, which is 350; 350 x 7 will be between 300 x 7 = 2100 and 400 x 7 = 2800. Another power of 7 would exceed the 3000 limit. So n = 4 is the only number that works for both equations.

18. Answer: A.

Explanation: Read carefully – did you notice that the tiles specified in Column A had a *perimeter* of 36 inches, while the tiles in Column B were specified using their *area*? This is especially easy to miss since 36 is a perfect square. For Column A, the tiles have side length of 36/4 = 9". You will need 72/9 = 8 tiles along the width, and 108/9 = 12 tiles along the length; (12)(8) = 96 tiles. Now, since the square border tiles have area of 9 square inches, they must have side length of 3". The width can be bordered by 72/3 = 24 tiles, while the length can be bordered by 108/3 = 36 tiles. Don't forget there are two lengths and two widths, for a total of 24 + 24 + 36 + 36 = 120 tiles. (You might also want to add another 4 tiles, for the corners, but it doesn't make a difference for this problem.) So more 3" small tiles are needed for the border (120) than large 9" tiles for the area (96). If you had used 6" tiles for the area as the problem attempted to mislead you, you would have needed 216 of them and mistakenly chosen A.

19. Answer: C

Explanation: You can write two equations in two unknowns from the information given: First, you know that if T = the number of cups sold on Tuesday and W = the number sold on Wednesday, then T + 80 = W. Second, you know the ratio W/T = 3/2. Substitute the first equation for W into the second and solve for T = 160; you could put that back into the first to find W = 240, but it's not necessary to answer the question, so you might prefer to save the time.

20. Answer: C.

Explanation: Don't get confused with the Jacks and Joes everywhere, and don't start right in calculating. Looking at the information given, you should realize that Jack and Joe actually earn the same rate of $200 a day. So it actually doesn't matter who works the 108 days, and who the 72, it will all add up to the same.

21. Answer: C.

Explanation: You shouldn't need your scratch paper for calculations like these; improve your mental math (and you can ALWAYS improve your mental math!) so you can save the time for other work. For Column A, first multiply by the 100, by moving the decimal point over twice: 6.3. Now multiply that by 2, to get 12.6. For Column B, multiply by the 10 by moving the decimal point over once: 4.2. Then multiply by the 3 to get 12.6.

22. Answer: B

Explanation: This is an "unknown operator" problem, and it is just another way of saying "given variables m and n, arrange them in this way and evaluate". So, for Column A, m♥n = $(-2)^2/[(-2)-2(3)] = 4/-8 = -\frac{1}{2}$. For Column B, m♥n = (3)2/[3-2(-2)] = 9/7.

23. Answer: D.

Explanation: This is a problem where blind plugging in of the answer choices could lead you astray. While it is true that the equation works for x = 5, there is a second root to the equation x = -4, which you could have found by factoring: (x -5)(x + 4) = 0 or Viete's Formulas $x_1x_2 = -20$ and $x_1 + x_2 = 1$. Since x = 5 or -4, you do not have enough information to say whether x is less than or equal to 5.

24. Answer: C.

Explanation: These look gnarly at first, but a closer look shows that the quantity under the radicand in Column A is a perfect cube, while the quantity under the radicand in Column B is a perfect square. For Column A, taking it piecewise might clarify things: : $\sqrt[3]{64y^3(xy)^6} = \sqrt[3]{64} \cdot \sqrt[3]{y^3} \cdot \sqrt[3]{(xy)^6} = 4y(xy)^2$. For Column B: $\sqrt{16} \cdot \sqrt{y^2} \cdot \sqrt{(xy)^4} = 4(xy)^2$.

25. Answer: B

Explanation: Of the 16 woven shirts, all could be green or yellow, so Column A = 0. For Column B, of the 30-16 = 14 knit shirts, a maximum of 13 of them can be red, yellow, or white (2 + 10 + 1); the last shirt must be something else. The range of possibilities is 1 to 13, all of which are greater than Column A.

26. Answer: C

Explanation: This is a ratio. Andy's height is to Brandon's height as the length of Andy's shadow is to the length of Brandon's shadow: 160/B = 400/300; so B = 120 (don't forget to change Andy's height into centimeters like the other measures.) Now, Column A = 2(120)=240, and Column B = 400-160 = 240.

27. Answer: C

Explanation: The factors of 36 are 3, 4, 6, 9, 12, 18, and 36; for 54 (up to 36): 2, 3, 6, 9, 18, 27 …; for 90 (up to 36): 1, 2, 3, 5, 6, 9, 10, 15, 18, 30 … The largest number that appears on both lists is 18. You can also arrive at the GCF by prime factorization. Since $36 = 2^2 3^2$, $54 = 2 \cdot 3^3$, and $90 = 2 \cdot 3^2 5$, the largest distinct powers that appear in all three factorizations are 2 and 3^2, so $2 \cdot 3^2 = 18$. For the multiples of the numbers in Column B, first note that 3 and 6 have 18 as a multiple, so 18 is the least common multiple. Note that Column B was a lot easier to figure out than Column A. If you had glanced over both and done B first, its result of 18 would have helped you decide about A. It's easy to see that 18 is a factor of 36, 54, and 90, so you wouldn't have had to bother with considering smaller ones; and that 36 isn't a factor of the other two. So the answer for A is 18 also.

28 . Answer: A.

Explanation: Complementary angles sum to 90, supplementary angles sum to 180, and triangle angles sum to 180. The complementary angle to the 36 is 90 - 36 = 54. So, angle b must be equal to 180 – 68 – 54 = 58. Angle a = 180 - 90 – 58 = 32. Alternatively, the supplementary angle to the 68 is 180 – 68 = 112, and a = 180 – 36 – 112 = 32.

29 . Answer: A.

Explanation: For Column A: Look only at the size of the premium sales column, without the regular sales: $\frac{9-10}{10} = -\frac{1}{10}$. For Column B: $\frac{15-16}{16} = -\frac{1}{16}$. Don't worry about converting to percent. Just compare the absolute values of the fractions. Although the value on the number line of a negative sixteenth is further to the right (greater value on the number line) than is a negative tenth, in this case the tenth (10%) is the larger change.

30. Answer: C.

Explanation: Summing the given percentages and subtracting from 100%, the lily and amaryllis sales share 24% of the total, in a ratio of 2:1. Dividing 24% into 3 parts of 8% each and giving lilies 2 parts and amaryllis 1 part, the lilies account for 16% of total sales. 16% of 700 is 112.