

Quantitative Reasoning Test 1: 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 1-14 have several different format- multiple choice questions and numeric entry questions. Unless directed select a single answer choice

1. $N = \{8, 9, 5, 3, 7, 13, 9, 2\}$

The sum of the mean, mode, median, and range of set N is

- A 34
- B 34.5
- C 36.5
- D 56
- E 448

2. Which of the following is equivalent to $(3x + 4y)(5x - 3y)$?

- I. $15x^2 - 12y^2$
- II. $(3x - 3y)(5x + 4y)$
- III. $-4y(-5x + 3y) + 3x(5x - 3y)$

- A III only
- B I only
- C II and III only
- D I and III only
- E I, II, and III

3. A to-go restaurant is running a special where customers can choose from among 10 dishes to make up a takeout box with 5 choices. The manager finds that the number of different boxes possible is:

- A 50
- B 252
- C 1200
- D 30,240
- E 3,628,800

4. A student has taken ten tests, with an average score of 87. There are three tests remaining in the term. If her final testing average is 90 or more, she will get an A for the class. The maximum score on the tests is 100. What must her average on the last three tests be to achieve an A in the class?

- A 87
- B 90
- C 96
- D 100
- E 110

5. A rectangular package has dimensions of 5, 4, and 3 units. Which of the following is the set of distinct possible products of the areas of two different sides?

- A {144, 225, 400}
- B {12, 15, 20}
- C {144, 180, 225, 240, 300, 400}
- D {24, 27, 30, 32, 35, 40}
- E {180, 240, 300}

6. A family keeps a bowl that contains ping-pong balls labeled with chores: tidy the hallway, wash dishes, mop kitchen floor, clean upstairs bathroom, vacuum living room, fold laundry, clean downstairs bathroom, and make the beds. One child particularly hates to use the vacuum cleaner. At chore time, she draws out two balls and must

complete the chores written on them. What is the chance that she will avoid having to vacuum?

- A $49/64$
- B $1/4$
- C $3/4$
- D $7/4$
- E $97/56$

7. A certain line on the xy plane contains the points $(3,2)$ and $(6,0)$. Which of the following points may also be found along this line?

- A $(1,2)$
- B $(0,4)$
- C $(2,3)$
- D $(3,5)$
- E $(5,6)$

8. The sum of Amy and Lauren's ages is 12. In 9 years, half of Amy's age will be the same as Lauren's age now. How old is Lauren now?

- A 1
- B 3
- C 5
- D 7
- E 9

9. If $2x + y = a$, and $5x + y = b$, then $x =$

- A $a - b$
- B $a + b$
- C $\frac{1}{7}(a + b)$
- D $-\frac{1}{3}(a - b)$
- E $6b + \frac{5a}{3}$

10. If 5 dollars can buy r flowers, how many dollars are needed to buy p bouquets? (One bouquet = 10 flowers.)

A $50(p + r)$

B $\frac{r}{50p}$

C $\frac{50}{r+p}$

D $\frac{p}{50r}$

E $\frac{50p}{r}$

11.

$$x \cdot \frac{4m}{6n} \cdot \frac{2n}{7p} \cdot \frac{5p}{q} \cdot \frac{3q}{4r} = \frac{m}{21}, \text{ SO } x =$$

A r

B $\frac{5m}{7r}$

C $\frac{7r}{5m}$

D $\frac{21}{m}$

E $\frac{r}{15}$

12. A spinner divided into equal sections numbered 0 through 8 is spun 3 times. What is the probability that the spinner lands on a prime number all three times?

A $\frac{16}{81}$

B $\frac{8}{9}$

C $\frac{25}{81}$

D $\frac{36}{81}$

E $\frac{10}{9}$

13. In California a redwood tree grows that is 150 feet high. At a certain time of day it casts a shadow 120 feet long. A nearby tree casts a shadow 180 feet long. How high is the second tree?

A 180

B 225

C 240

D 300

E 360

14.

An investor divides \$10,000 into two investments, one paying 7% and one 8% annually. At the end of the year she has made \$720. How much did she invest at 8%?

A \$1000

B \$2000

C \$4800

D \$6300

E \$9000

Direction: For each of question, 15-30, 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.**

15. Joseph ate x number of cookies. Jane ate y number more cookies than Joseph. Albert ate three times the number of cookies that Joseph ate.

Column A: $y + 1 + 5x$

Column B: total number of cookies eaten

- 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. y is 60% of 30, and 8 is $x\%$ of 40

Column A: x

Column B: $y + 2$

- 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.

Column A: $\sqrt{81}$

Column B: $\sqrt{9 + 25 + 36}$

- 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. $N = \{32, 48, 50, 24, 64\}$

Column A:

The sum of the mean and the range of set N

Column B:

The sum of the range and the median of set 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.

19. The average of ten numbers is 11. The average of six of these numbers is 13. The average of the remaining numbers is x .

Column A: 40

Column B: $4x$

- 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.

Column A: $0(8)^5$

Column B: $16(-5)^3$

- 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. $x < 0$ and $x > y$

Column A: x^5y^5

Column B: $(xy)^6$

- 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.

22.

Column A: 64^3

Column B: 16^5

- 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.

23. A salesman's commission on selling factory equipment is a certain percentage c . He earns \$2940 on a sale of \$42,000.

Column A: \$3880

Column B: His commission on a sale of \$56,000

- 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: $7^3/42^2$

Column B: $5/36$

- 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. $7x^6y^5 > 0$, and $7x^5y^6 < 0$.

Column A: x

Column B: y

- 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. $x < 18$

Column A: $x + 4$

Column B: 21

- 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.

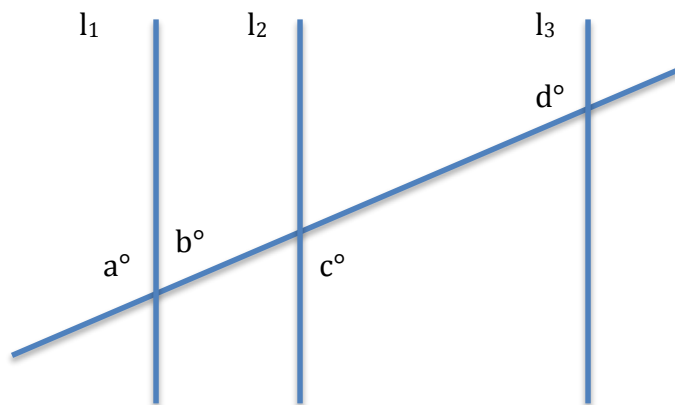
27.

Column A: $\frac{2}{5} + \frac{9}{12} - \frac{3}{7} + \frac{5}{16}$

Column B: $\frac{5}{16} - \frac{3}{7} + \frac{7}{13} + \frac{2}{5}$

- 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.

28. Lines l_1 , l_2 , and l_3 are parallel; the diagonal line is straight.

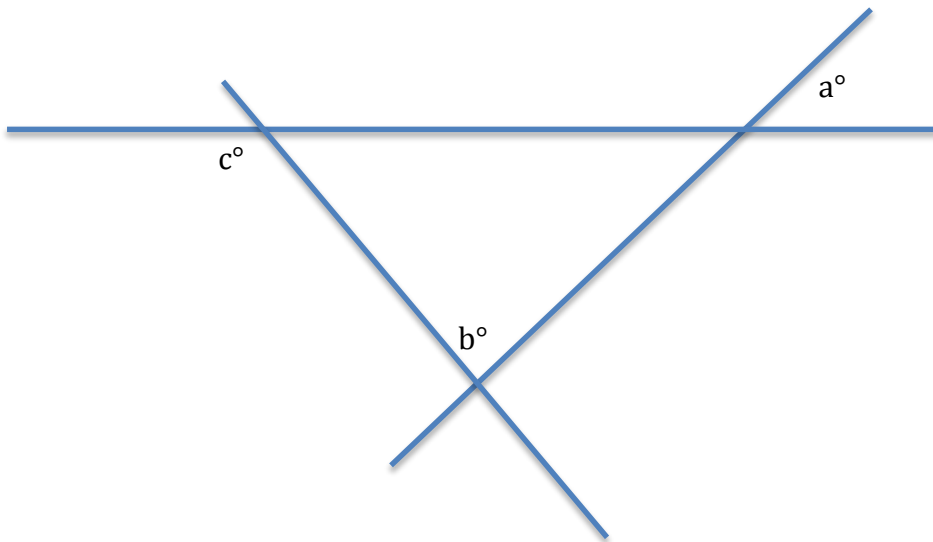


Column A: $a + d$

Column B: $c - b + 180$

- 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.

29.



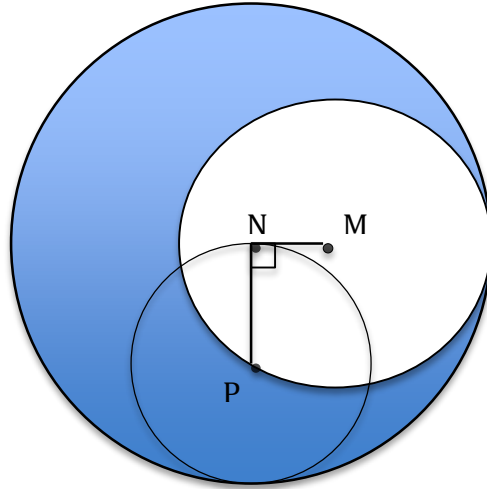
All lines are straight and intersect as shown.

Column A: c

Column B: $a + b$

- 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.



Given: The large circle has its center at point N. The medium circle has its center at M and is tangent to the large circle. The small circle has its center at point P, intersects point N, and is tangent to the large circle. NP is 8 units long. NM is 6 units long and is perpendicular to NP.

Column A: area of the shaded portion

Column B: 2.5 times the area of the small circle

- 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.

Answers & Explanation

1. Answer: B.

Explanation: The mean is the average of the numbers, and equals 7. The mode, or most frequently occurring number, is 9. Order the set from lowest to highest value; the range is the difference between the highest number and the lowest, and equals $13 - 2 = 11$. Since there are an even number of elements in the set, the median is the average of the middle two, or 7.5. The sum of these is $7 + 9 + 11 + 7.5$, or 34.5.

2. Answer: A.

Explanation: Those proficient with the distributive property and FOIL can expand the statements and look for correspondence. The given statement expands to $15x^2 - 9xy + 20xy - 12y^2 = 15x^2 + 11xy - 12y^2$, which is clearly not equal to statement I; this eliminates B, D, and E as answer choices. Statement II expands to $15x^2 + 12xy - 15xy + 12y^2 = 15x^2 - 3xy + 12y^2$, again also a clear mismatch. This eliminates choice C. Only choice A remains, so you could safely pick it and save the time for another question. For those who find the prospect of handling the algebra daunting, fake it by choosing numbers for x and y and plugging in to find a match. Don't pick 0 as a test number for either x or y; you will erroneously find statement I to work. Plugging in will take more time than the algebra.

3. Answer: B.

Explanation: The question to answer is "How many groups of 5 can be made from 10 choices?" This is a combination problem, since there is no order to the choices. There are 10 choices for the first slot, 9 choices for the second, 8 for the third, 7 for the fourth, and 6 for the fifth, so $10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 = 30,240$. Next, divide by the factorial of the number of slots: $5! = 5 \cdot 4 \cdot 3 \cdot 2 = 120$, so $30,240/120 = 252$.

4. Answer: D.

Explanation: This is an algebra problem. If she takes 10 tests and effectively got an 87 on all of them, and three tests with the unknown target score, if she gets an average of 90 it will be as if she took 13 tests and got a 90 on all of them: $10(87) + 3(x) \leq 12(90)$. Solving, $x = 100$, meaning she will have to get a perfect score on the remaining tests to get her A.

5. Answer: C.

Explanation: The possible areas are $5 \cdot 4 = 20$, $5 \cdot 3 = 15$, and $4 \cdot 3 = 12$. Note that there are two of each of these on the package (although erroneous answer choice E is happy to accommodate you if you neglect this fact). So, each of the areas of 20, 15, and 12 can make a product with 20, 15, and 12. The set listed in C gives all these possible combinations

6. Answer: C.

Explanation: On her first draw, she has 7 out of 8 possible chances to avoid the vacuuming. If she is successful and the vacuum ball remains in the bowl, 6 of the remaining 7 balls are non-vacuum. So her chances overall of avoiding the vacuum job are $\frac{7}{8} \cdot \frac{6}{7} = \frac{6}{8} = \frac{3}{4}$. Remember to cancel the 7's in the numerator and denominator and to factor out the 2 in the 6 and 8, to save multiplication trouble and leave the result in lowest terms.

7. Answer: B.

Explanation: Find the equation of the line in the format $y = mx + b$, where m is the slope and b is the y -intercept. First find m from the two given points, the rise/run or change in y over the change in x :

$$m = \frac{(0 - 2)}{(6 - 3)} = \frac{-2}{3}$$

Now find b by using one of the points in the formula and the m just found:

$$y = mx + b, \text{ or } b = y - mx$$

Using point (3,2):

$$b = 2 - \left(\frac{-2}{3}\right)3 = 2 - 2 = 4$$

so the equation of the line is $y = \left(\frac{-2}{3}\right)x + 4$. Pause to note that since all of the answer choices have $x \geq 0$, then the point we are looking for will have $y \leq 4$. This eliminates choices D and E. Choices A and C can be eliminated because their x-coordinates would result in a fractional y, and none of the given y-coordinates are fractions. Only choice B is left; check it if you have time, otherwise select it and move on.

(0,4):

$$4 = \left(\frac{-2}{3}\right)0 + 4$$

8. Answer: D.

Explanation: Ah, yes, everyone's favorite: algebra age problems! The key here is to note which quantities are true now, and which in 9 years. Let A = Amy's age now, and L = Lauren's age now. We know that now, $A + L = 12$, or $A = 12 - L$. In 9 years, Amy will be $A + 9$. Half of that will be the same as Lauren is now, or L :

$$\frac{(A + 9)}{2} = L$$

Be careful that you do not use $(L + 9)$ here; the question says "the same as Lauren's age now"; the problem has been so designed that you will get an answer that works if you misread the question, and of course it's one of the answer choices. Now you have two equations in 2 unknowns. Substitute the first into the second and solve for L .

9. Answer: D.

Explanation: These are simultaneous equations. Subtract one from the other to cancel the y's, and solve for x. For example, $(2x + y = a) - (5x + y = b) = (-3x = a - b)$, so $x = -\frac{1}{3}(a - b)$.

10. Answer: E.

Explanation: This is a proportion problem. What is being asked is "5 is to r as what is to p?" Note that the number of flowers needed to make the p bouquets is 10p. Now you can compare flowers to flowers. Set up the proportion and solve for x:

$$\frac{5}{r} = \frac{x}{p(10)}$$

11. Answer: E.

Explanation: If you are unsure of how to begin, glance ahead at the answer choices to get an idea of what the answer will look like and note that they are all in terms of m, r, or both, so the other variables and a good number of the coefficients must cancel. The equation simplifies to $\frac{5xm}{7} = \frac{m}{21}$. Solve for x.

12. Answer: A

Explanation: Uh, oh, did you review the definitions for prime numbers? Do you remember if 0 and/or 1 is prime? Well, 0 is not prime, and neither is 1, which leaves 4 prime number possibilities of the 9 total. Since the spins are independent events, multiply the chances of the prime numbers together:

$$\frac{4}{9} \cdot \frac{4}{9} = \frac{16}{81}$$

Of course the other answer choices represent what happens if you miscount primes or add instead of multiply. Evil! (Although if you really just had to guess, you could at least eliminate E as being greater than the maximum probability of 1.)

13. Answer: B

Explanation: This is a proportion problem. $\frac{150}{120} = \frac{x}{180}$. Since you may not use a calculator on the test, be sure to cancel out the common factor of 30 to save multiplication time:

$$\frac{150 \cdot 180}{120} = \frac{30(5) \cdot 30(6)}{30(4)} = \frac{900}{4} = 225$$

14. Answer: B

Explanation: Let x = the amount invested at 8%, and $10000 - x$ = the amount invested at 7%. Then,

$$0.08x + 0.07(10000 - x) = 720$$

Multiply the whole equation by 100 to get rid of the decimal:

$$8x + 7(10000 - x) = 72000$$

$$8x + 70000 - 7x = 72000$$

$$x = 2000$$

If you have forgotten how to do this sort of problem, remember that the answer is one of the given choices. You can plug in to zero in on it. Since the answer choices are arranged in value order, choose the middle one to start and then go from there. Does 8% of \$4800 plus 7% of (\$10,000 - \$4800) equal 720?

$$0.08(4800) + 0.07(5200) = 748.$$

A little too big; pick the next smallest answer (check it if you think you have time, otherwise just move on, avoiding the mental distraction of wishing your investments have done as well as hers.)

$$0.08(2000) + 0.07(8000) = 160 + 560 = 720.$$

15. Answer: A.

Explanation: The expression for the total number of cookies eaten is $5x + y$. Note that there is no such thing as a negative cookie, so you don't have to consider negative numbers. For any $x \geq 0$ and $y \geq 0$, the expression in Column A will be one larger.

16. Answer: C.

Explanation: Translate the first statement into algebra and solve: $y = (60/100)(30) = 18$. Translate the second into algebra and solve: $8 = (x/100)(40)$, so $x = 20$. Note that $x > y$, but that is not what is being compared, so don't pick answer choice A. Instead, confirm that $x = y + 2$ for answer choice C.

17. Answer: A.

Explanation: Don't be fooled into thinking that $\sqrt{9 + 25 + 36}$ is equivalent to $\sqrt{9} + \sqrt{25} + \sqrt{36} = 3 + 5 + 6 = 14$. You can't separate out addends from under the radicand like that (only factors). Instead, add them up: $\sqrt{9 + 25 + 36} = \sqrt{70}$. Whatever $\sqrt{81}$ is (if you didn't know), it will be larger than $\sqrt{70}$.

18. Answer: B.

Explanation: First, list the set elements in value order. Then find the mean (the average): $(24 + 32 + 48 + 50 + 64)/5 = 43.6$. Next, find the range: $64 - 24 = 40$. Finally, find the median, the middle value in the ordered set: 48. The sum of the mean and the range is $43.6 + 40 = 83.6$. The sum of the range and median is $40 + 48 = 88$.

19. Answer: A.

Explanation: From the first statement, you could say that you have a total of 110 to work with (10 numbers altogether) \times (an average value of 11). From the second statement, (6 numbers) \times (an average value of 13), or 78, is accounted for, leaving 32. There are four numbers left to provide the 32: (4 numbers) \times (average value) = 32. Their average value

must be 8. This is x ; $4x = 32$, less than Column A. If you had little time left on the test and had to take an educated guess, you could note that since the average of the first six numbers is greater than the overall average, the average of the last four numbers will need to be somewhat less. In order to be equal to Column A, their average would need to be 10. You might estimate that this is not enough smaller for the last four numbers to bring the overall average down to 11. So, if the unknown average of the last 4 numbers is less than 10, Column B will always be smaller than A.

20. Answer: A.

Explanation: Recall that zero multiplied by anything is zero, so Column A evaluates to 0. Do not calculate Column B. Instead, recall that an odd power of a negative number is always negative. So, whatever $16(-5)^3$ is, it will be less than zero (further left on the number line).

21. Answer: D.

Explanation: First, note that x^5y^5 is equivalent to $(xy)^5$. Since both x and y are negative, xy will be positive, and xy taken to the 5th or 6th power will also be positive. You might be tempted to answer B, that something to the 6th power will always be larger than something to the 5th power. Not so with fractions, however (tricky!) If x and y are fractions, higher powers of xy get smaller and smaller.

22. Answer: B.

Explanation: Tip: Do not calculate, it takes too long. You don't care what the complete expressions evaluate to, all you need to do is compare Column A with Column B. Looking at the two numbers, note that you can factor them so that they have the same base; then just compare the powers. For example, $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$, while $16 = 2 \times 2 \times 2 \times 2 = 2^4$. So Column A is $(2^6)^3 = 2^{18}$, while Column B = $(2^4)^5 = 2^{20}$. Whatever 2^{20} is, it's bigger than 2^{18} . You could also just factor with 4, if you happen to think of that first. Column A equals $(4 \times 4 \times 4)^3 = (4^3)^3 = 4^9$, while Column B equals $(4 \times 4)^5 = (4^2)^5 = 4^{10}$. Whatever 4^{10} is, it's bigger than 4^9 .

23. Answer: B.

Explanation: You might be tempted to use the information given to solve for c and find that the salesman's percentage is 7% and then apply that rate to the \$56,000, but it is easier to set up a proportion: $\frac{2940}{42000} = \frac{\text{commission}}{56000}$. Factoring comes in handy: $\text{commission} = \frac{(2940)(56000)}{(42000)} = \frac{(2940)(7)(8)(1000)}{(7)(6)(1000)}$. Cancelling and reducing, this reduces to $\frac{4(2940)}{3}$. Brief calculation results in \$3920, more than Column A.

24. Answer: A.

Explanation: You could compare these two expressions by looking at what their numerators would be if they were to have the same denominators. To do this, cross-multiply (multiply each fraction's numerator by the other's denominator.) Since $7^3 \times 36 > 5 \times 42^2$, the fraction in Column A "wins" and is greater overall. Doing this "brute force" multiplication by hand takes about a minute.

A more elegant way to do it is to factor each expression:

$$\text{For Column A, } \frac{(7 \times 7 \times 7)}{(2 \times 3 \times 7)^2} = \frac{7}{(2^2 \times 3^2)}$$

$$\text{For Column B, } \frac{5}{(2^2 \times 3^2)}$$

The denominators are now the same, and since in the numerators $7 > 5$, Column A "wins". This calculation takes about 40 seconds if you are good at factoring. You kind of have to "see" in advance that the cancellation of the 7's is going to work, though.

25. Answer: B.

Explanation: This is neither calculation nor algebra, it's logic. Look at the second statement first. Recall that even powers of numbers are always positive, while odd powers are positive if the number is positive, and negative if the number is negative. So, if the second expression is overall negative (less than zero), then it must be that x is negative. We

don't know about y yet, it could be either positive or negative. Now, looking at the first statement, we see that y must be positive since the entire expression is positive. If x is negative and y is positive, y is greater than x .

26. Answer: D.

Explanation: You want to see if one column is ALWAYS greater than, less than, or equal to the other, for any number x . Plug in some sample numbers that could help determine this. For example: If $x = 17$, the columns are equal. If x is anything less than that, Column B is greater. If $x = 17.5$ (nothing here says it has to be an integer, only a real number), Column A is greater. Whether Column A or Column B is greater or they are equal depends on what you choose for x ; it can't be determined from the information given.

27. Answer: A.

Explanation: Don't start off by calculating. You don't care what the complete expressions evaluate to, all you need to do is compare Column A with Column B. Three of the same fractions appear in both Columns, and so may be said to "cancel out". Now all you have to do is compare $9/12$ and $7/13$. $9/12$ simplifies to $3/4$. The LCD of $3/4$ and $7/13$ is 52, so now you are comparing $39/52$ with $28/52$. (You could also cross-multiply and compare $13 \cdot 3$ vs. $4 \cdot 7 = 39$ vs. 28 .) $39/52$, part of the expression in Column A, is greater.

28. Answer: C.

Explanation: When lines intersect, adjacent angles sum to 180. For example, $a + b = 180$. Therefore, $b = 180 - a$. In the diagram, angles a , c , and d are equal, created by the diagonal line cutting across the parallel lines, and the letters are interchangeable. The expression in Column B may be rewritten: $c - b + 180 = c - (180 - a) + 180 = c + a = d + a$.

29. Answer: C.

Explanation: The vertical angle across from a (call it d) equals a . The supplementary angle adjacent to c (call it e) is $180 - c$. Since the angles

of a triangle must add up to 180, $d + b + e = 180$. Substituting a for d and $(180 - c)$ for e , $a + b + 180 - c = 180$. Solving for c , $c = a + b$.

30. Answer: B.

Explanation: The triangle NMP is a 6-8-10 right triangle; the radius of the medium circle, MP, equals 10. Since NP = 8, the radius of the large circle (twice NP) equals 16. The shaded area is the area of the large circle minus the area of the medium circle: $A_{shaded} = \pi 16^2 - \pi 10^2 = 156\pi$. 2.5 times the area of the small circle is $2.5 \cdot \pi 8^2 = 160\pi$.