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arranged by **Topic** and **Difficulty** Level

By Dr. Steve Warner

320 Level 1, 2, 3, 4, and 5 Math Problems for the GRE

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Problems by Level and Topic with Fully Explained Solutions

Note: The quickest solution will always be marked with an asterisk (*).

Level 1: Arithmetic

1. Quantity A: 5^4
   Quantity B: 6^3

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

*** Calculator solution:** $5^4 = 5 \cdot 5 \cdot 5 \cdot 5 = 625$ and $6^3 = 6 \cdot 6 \cdot 6 = 216$.

So 5^4 is greater than 6^3, choice A.

Note: The expression 5^4 means to multiply the number 5 by itself 4 times. We can do this with the calculator.

Similarly, 6^3 means to multiply the number 6 by itself 3 times.

2. Quantity A: The number of days in 9 weeks
   Quantity B: The number of months in 5 years

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

* Since there are 7 days in a week, in 9 weeks there are $7 \cdot 9 = 63$ days.

Since there are 12 months in a year, in 5 years there are $12 \cdot 5 = 60$ months.

So the number of days in 9 weeks is greater than the number of months in 5 years, choice A.

In a decimal number, a bar over one or more consecutive digits means that the pattern of digits under the bar repeats without end. For example, $0.\overline{123} = 0.123123123\ldots$

3. Quantity A: $0.\overline{43}$
   Quantity B: $0.\overline{434}$

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

*

$$0.\overline{43} = 0.434\mathbf{3}43\ldots$$
$$0.\overline{434} = 0.434\mathbf{4}34434\ldots$$

We can compare two decimals by looking at the first position where they disagree. Notice that the first place these two numbers disagree is the fourth position after the decimal point (marked in bold above). In $0.\overline{43}$ this digit is a 3 and in $0.\overline{434}$ this digit is a 4. So $0.\overline{434}$ is greater, choice B.

$s = 3.02973$ and s^* is the decimal expression for s rounded to the nearest hundredth.

4. Quantity A: The number of places where s and s^* differ
   Quantity B: 3

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

* $s^* = 3.03 = 3.03000$. So we see that s and s^* differ in 4 places. So Quantity A is greater, choice A.

Notes: (1) In the number 3.02973, the leftmost 3 is in the **ones** place, the 0 is in the **tenths** place, the 2 is in the **hundredths** place, the 9 is in the **thousandths** place, the 7 is in the **ten thousandths** place, and the rightmost 3 is in the **hundred thousandths** place.

(2) Since we are being asked to round s to the nearest hundredth, we focus on the 2 which is in the hundredths place. We look at the next position to the right (the thousandths place) to determine if we round up or down. Since that digit is at least 5 (more specifically it is 9) we round the 2 up to a 3.

(3) s and s^* differ in the hundredths, thousandths, ten thousandths, and hundred thousandths places.

(4) The **tenths** place is different from the **tens** place. For example, in the number 235.46, the digit 3 is in the tens place, whereas the digit 4 is in the tenths place. Similarly, the digit 2 is in the hundreds place, whereas the digit 6 is in the hundredths place.

5. $(34 - 33 - 32 - 31 - 30) - (35 - 34 - 33 - 32 - 31) =$

   A. -60
   B. -10
   C. -6
   D. 2
   E. 3

*** Quick solution:** -33, -32, and -31 appear in both pairs of parentheses. Since we are subtracting we can delete those numbers to get $(34 - 30) - (35 - 34) = 4 - 1 = 3$, choice E.

Solution using the distributive property: We eliminate the parentheses by distributing the subtraction symbol to get

$$34 - 33 - 32 - 31 - 30 - 35 + 34 + 33 + 32 + 31.$$

We can now cancel the 33's, 32's, and 31's to get

$34 - 30 - 35 + 34 = 4 - 35 + 34 = -31 + 34 = 3$, choice E.

Note: We can also solve this by direct computation with the help of the calculator. Be careful when using the calculator for this one as it is very easy to make an error.

6. Of the following, which is closest to $\sqrt[3]{70}$

   A. 2
   B. 3
   C. 4
   D. 5
   E. 6

*** Solution by starting with choice C:** We start with choice C and compute $4^3 = 4 \cdot 4 \cdot 4 = 64$. This is a little less than 70.

Let's try D to be safe: $5^3 = 5 \cdot 5 \cdot 5 = 125$. This is much further from 70 than 64. So the answer is choice C.

Notes: (1) $70 - 64 = 6$, so that 64 is 6 units away from 70.

Also, $125 - 70 = 55$, so that 125 is 55 units away from 70.

Since 64 is much closer to 70, it follows that $4 = \sqrt[3]{64}$ is closer to $\sqrt[3]{70}$.

(2) When plugging in answer choices, it's always a good idea to start with choice C unless there is a specific reason not to. In this problem, by trying choice C, we were able to eliminate choices A and B right away, possibly saving some time.

7. Which of the following numbers is less than 0.216? Indicate all such values.

A. 0.2106
B. 0.2159
C. 0.2161
D. 0.2166
E. 0.22
F. 0.221

* We can compare two decimals by looking at the first position where they disagree. For example, 0.215 is less than 0.216 because 5 is less than 6. If a digit is missing, there is a hidden 0 there. Thus, 0.2 is also less than 0.216 because 0.2 is the same as 0.200 and 0 is less than 1 (remember that we look at the **first** position where the decimals disagree).

Using the above reasoning we see that 0.2159 is less than 0.216 and 0.2161 is greater than 0.216. Since the answers are listed in increasing order, the answers are choices A and B.

8. Each of A, B, C, D and E are distinct numbers from the set $\{2, 15, 25, 31, 34\}$ such that A is prime, B is even, C and D are multiples of 5, and $A < E < B$. What is E ?

* Remember that a prime number is a positive integer with **exactly** 2 factors (1 and itself). Since A is prime, it is either 2 or 31. Since B is even and greater than A it must be 34. Since C and D are multiples of 5 they must be 15 and 25 (not necessarily in that order). So E must be **31**.

Definitions: The **integers** are the counting numbers together with their negatives.

$$\{\ldots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \ldots\}$$

The **positive integers** are the positive numbers from this set.

$$\{1, 2, 3, 4, 5, 6, \ldots\}$$

A **prime number** is a positive integer that has **exactly** two factors (1 and itself). Here is a list of the first few primes:

$$2, 3, 5, 7, 11, 13, 17, 19, 23, \ldots$$

Note that 1 is **not** prime. It has only one factor!

A **composite number** has **more** than two factors. Here is a list of the first few composites:

$$4, 6, 8, 9, 10, 12, 14, 15, 16, \ldots$$

LEVEL 1: ALGEBRA

$$z = -6$$

9. Quantity A: $5z^2$
   Quantity B: 180

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

* $5z^2 = 5(-6)^2 = 5(-6)(-6) = 5 \cdot 36 = 180$. So the two quantities are equal, choice C.

$$b < -2$$

10. Quantity A: $b + 1$
    Quantity B: -2

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

Algebraic solution: We add 1 to each side of the given inequality to get $b + 1 < -2 + 1 = -1$.

So, for example, $b + 1$ could be -2 in which case Quantities A and B would be equal.

On the other hand, $b + 1$ could be -3 in which case Quantities A and B would not be equal.

So the answer is choice D.

Computation in detail: We add one to each side of the given inequality:

$$\begin{array}{r} b < -2 \\ \underline{+1 \quad +1} \\ b + 1 < -1 \end{array}$$

*** Solution by picking numbers:** If $b = -3$, then $b + 1 = -2$, and Quantities A and B are equal.

If $b = -4$, then $b + 1 = -3$, and Quantities A and B are not equal.

So the answer is choice D.

$$y = 3x - 5$$
$$x = -2$$

11. Quantity A: y
    Quantity B: -11

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

*** Algebraic solution:** Since $x = -2$, we have

$$y = 3x - 5 = 3(-2) - 5 = -6 - 5 = -11$$

So Quantities A and B are equal, choice C.

x is an integer greater than 0

12. Quantity A: $3x + 7$
    Quantity B: $7x + 3$

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

*** Solution by picking numbers:** If $x = 1$, then $3x + 7 = 3 \cdot 1 + 7 = 10$ and $7x + 3 = 7 \cdot 1 + 3 = 10$. So Quantities A and B are equal.

If $x = 2$, then we have $3x + 7 = 3 \cdot 2 + 7 = 6 + 7 = 13$ and also $7x + 3 = 7 \cdot 2 + 3 = 14 + 3 = 17$. So Quantities A and B are not equal.

So the answer is choice D.

13. If $2t = 8$ and $3s + t = 13$, what is the value of s?

    A. 2
    B. 3
    C. 4
    D. 5
    E. 6

Solution by starting with choice C: Looking at the first equation we see that t must be 4 (since $2 \cdot 4 = 8$). Substituting $t = 4$ into the second equation we get

$$3s + 4 = 13$$

Now let's start with choice C as our first guess. We substitute 4 in for s.

$$3 \cdot 4 + 4 = 13$$
$$12 + 4 = 13$$
$$16 = 13$$

Since 16 is too big we can eliminate choices C, D and E.

We next try choice B and substitute 3 in for s.

$$3 \cdot 3 + 4 = 13$$
$$9 + 4 = 13$$
$$13 = 13$$

Since we get a true statement, the answer is choice B.

*** Algebraic solution:** Solving the first equation for t we get $t = 4$ (because $t = \frac{8}{2} = 4$). Substituting $t = 4$ into the second equation we get

$$3s + 4 = 13$$
$$3s = 9$$
$$s = 3$$

Thus, the answer is choice B.

Remark: The more advanced student should be able to do all of these computations in his/her head.

14. If $3 + x + x + x = 1 + x + x + x + x + x$, what is the value of x?

   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

Solution by starting with choice C: Begin by looking at choice C. We substitute 3 in for x on both sides of the equation.

$$3 + 3 + 3 + 3 = 1 + 3 + 3 + 3 + 3 + 3$$
$$12 = 16$$

Since this is false, we can eliminate choice C. A little thought allows us to eliminate choices D and E as well. We'll try choice B next.

$$3 + 2 + 2 + 2 = 1 + 2 + 2 + 2 + 2 + 2$$
$$9 = 11$$

Finally, let us check that choice A is correct.

$$3 + 1 + 1 + 1 = 1 + 1 + 1 + 1 + 1 + 1$$
$$6 = 6$$

Thus, the answer is choice A.

Algebraic solution:

$$3 + x + x + x = 1 + x + x + x + x + x$$
$$3 + 3x = 1 + 5x$$
$$2 = 2x$$
$$1 = x$$

Thus, the answer is choice A.

Remark: We can begin with an algebraic solution, and then switch to the easier method. For example, we can write $3 + 3x = 1 + 5x$, and then start substituting in the answer choices from here. This will take less time than the first method, but more time than the second method.

*** Striking off x's:** When the same term appears on both sides of an equation we can simply delete that term from both sides. In this problem we can strike off 3 x's from each side to get $3 = 1 + x + x$. This becomes $2 = 2x$ from which we see that $x = 1$, choice A.

15. John has fewer nickels than Phil, but more than Thomas. If J, P and T represent the number of nickels that each boy has, respectively, which of the following can be true? Indicate all such inequalities.

A. $J < P < T$
B. $J < T < P$
C. $P < J < T$
D. $P < T < J$
E. $T < J < P$
F. $T < P < J$

* When using the symbols "<" and ">", the symbol always points to the smaller number. We will use only the symbol "<" since this is the only symbol that appears in the answer choices. Since John has fewer nickels than Phil we have $J < P$. Since John has more nickels than Thomas we have $T < J$. Putting these two together gives us $T < J < P$. Thus, the only answer is choice E.

Remark: It might seem more natural to write $J > T$ because of the wording in the problem. This is fine, but you then just need to realize that $T < J$ means the same thing. Note again that in the end we want to have only the symbol "<" because this is the only symbol appearing in the answer choices.

16. If $5x - 4 = 26$, then $7x =$

*** Algebraic solution:** We add 4 to each side of the given equation to get $5x = 26 + 4 = 30$. Dividing each side of this last equation by 5 gives us $x = \frac{30}{5} = 6$. So $7x = 7 \cdot 6 = \mathbf{42}$.

Notes: (1) Be careful to finish the problem here. The question is asking for $7x$, and not just x.

(2) Instead of solving the first equation algebraically, we can also find x by taking guesses.

For example, if we take a guess that $x = 3$, then we have

$$5x - 4 = 5 \cdot 3 - 4 = 15 - 4 = 11.$$

This is too small. So we need to guess a larger number.

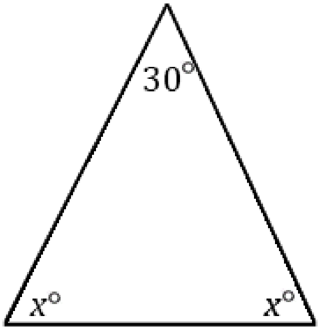
If we then try $x = 6$, we have

$$5x - 4 = 5 \cdot 6 - 4 = 30 - 4 = 26.$$

This is correct, and so $x = 6$.

It follows that $7x = 7 \cdot 6 = \mathbf{42}$.

LEVEL 1: GEOMETRY



17. Quantity A: x
    Quantity B: 75

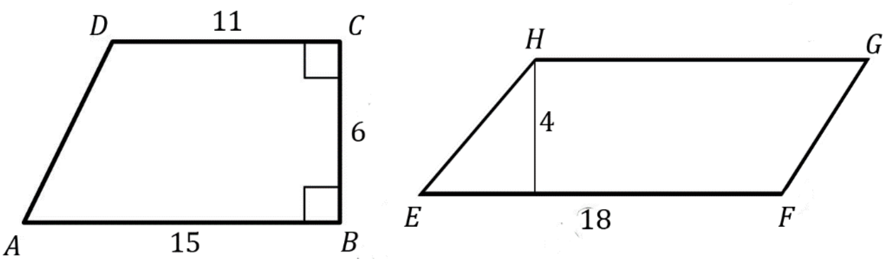
    A. Quantity A is greater.
    B. Quantity B is greater.
    C. The two quantities are equal.
    D. The relationship cannot be determined from the information given.

Solution by trying Quantity B: Let's try Quantity B for x. That is we will set x equal to 75. It follows that the sum of the angle measures of the triangle is $x + x + 30 = 75 + 75 + 30 = 180$. This is exactly what the angle measures of a triangle are supposed to add up to. So x is in fact 75 and the two Quantities are equal, choice C.

* **Algebraic solution:** Using the fact that the angle measures of a triangle sum to 180° we have

$$x + x + 30 = 180$$
$$2x + 30 = 180$$
$$2x = 150$$
$$x = 75$$

So the two Quantities are equal, choice C.



18. Quantity A: The area of trapezoid *ABCD*
    Quantity B: The area of parallelogram *EFGH*

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

* The area of the trapezoid is $\frac{1}{2}(11 + 15)(6) = 78$ and the area of the parallelogram is $18 \cdot 4 = 72$. So Quantity A is greater than Quantity B, choice A.

Notes: (1) The area of a trapezoid is $A = \frac{1}{2}(b_1 + b_2)h$ where b_1 and b_2 are the two bases of the trapezoid and h is the height of the trapezoid.

In other words, to find the area of a trapezoid, we first find the average of the two bases, and then multiply this result by the height.

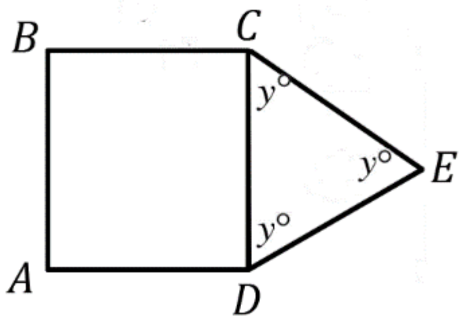
In trapezoid $ABCD$ the bases have lengths 11 and 15, and the height has length 6.

(2) The area of a parallelogram is $A = bh$ where b is the base of the parallelogram and h is the height of the parallelogram.

In parallelogram $EFGH$ the base has length 18, and the height length 4.

(3) For both figures, the height is always the perpendicular distance between bases.

Interesting observation: The formulas for the area of a trapezoid and the area of a parallelogram are actually the same. The formula for the parallelogram looks simpler because both bases have the same length. So when we take their average, we just get the common number back (for example, the average of 18 and 18 is $\frac{18+18}{2} = \frac{36}{2} = 18$).



Square $ABCD$ has area 25

19. Quantity A: The perimeter of pentagon $ADECB$
Quantity B: 30

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

* Since the square has area 25, the side length of the square is $\sqrt{25} = 5$. Since all angles of the triangle are equal, the triangle is equilateral, and so each side of the triangle also has length 5. It follows that the perimeter of $ADECB$ is $5 \cdot 5 = 25$. So Quantity B is greater than Quantity A, choice B.

Notes: (1) The area of a square is $A = s^2$ where s is the length of a side of the square.

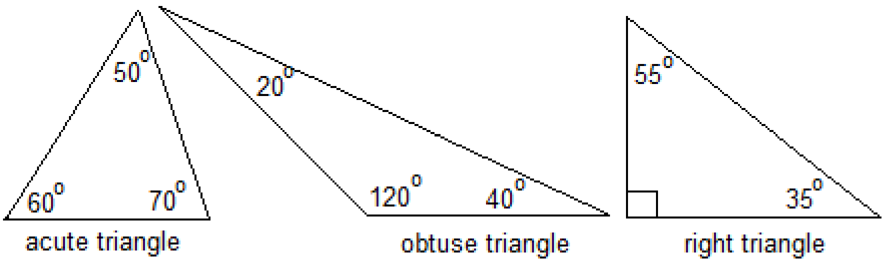
In square $ABCD$ we are given that $A = 25$. So $s^2 = 25$ and it follows that $s = \sqrt{25} = 5$.

(2) Normally the equation $s^2 = 25$ would have the two solutions $s = \pm 5$. But a length cannot be negative and so we only consider the positive solution.

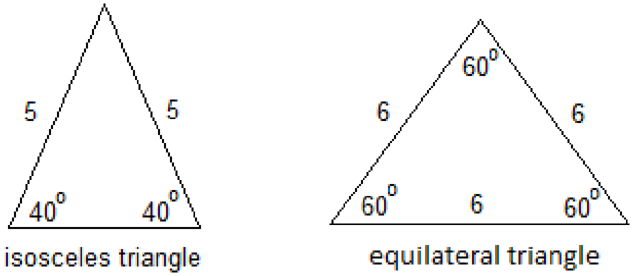
(3) An equilateral triangle has 3 sides of equal length. Equivalently, an equilateral triangle has 3 angles of equal measure (in which case they all measure $60°$) .

(4) To get the perimeter of a geometric figure we add up all the side lengths. Note that CD is not part of the perimeter of $ADECB$.

A basic lesson in triangles: A **triangle** is a two-dimensional geometric figure with three sides and three angles. The sum of the degree measures of all three angles of a triangle is 180.

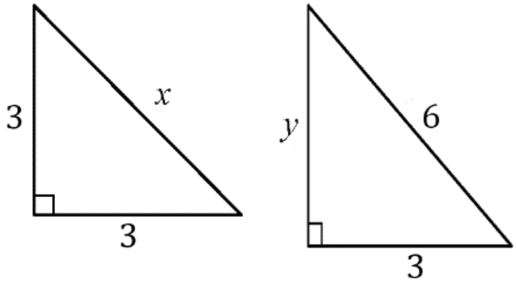


A triangle is **acute** if all three of its angles measure less than 90 degrees. A triangle is **obtuse** if one angle has a measure greater than 90 degrees. A triangle is **right** if it has one angle that measures exactly 90 degrees.



A triangle is **isosceles** if it has two sides of equal length. Equivalently, an isosceles triangle has two angles of equal measure.

A triangle is **equilateral** if all three of its sides have equal length. Equivalently, an equilateral triangle has three angles of equal measure (all three angles measure 60 degrees).



20. Quantity A: x
    Quantity B: y

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

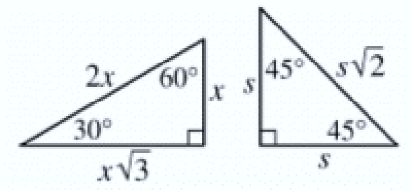
*** Solution using the Pythagorean theorem:** By the Pythagorean Theorem we have $x^2 = 3^2 + 3^2 = 9 + 9 = 18$. Also by the Pythagorean Theorem we have $y^2 = 6^2 - 3^2 = 36 - 9 = 27$. Since $y^2 > x^2$, and x and y are both positive, $y > x$. So the answer is B.

Notes: (1) The Pythagorean Theorem says that $c^2 = a^2 + b^2$ where a and b are the lengths of the legs of the right triangle and c is the length of the hypotenuse.

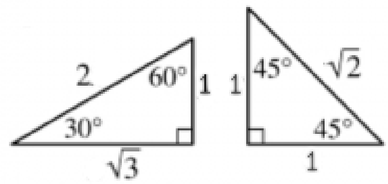
(2) When applying the Pythagorean Theorem always remember that the hypotenuse is by itself on one side of the equation. So for the rightmost triangle we have $6^2 = y^2 + 3^2$, or equivalently $y^2 = 6^2 - 3^2$.

(3) The leftmost triangle is an **isosceles right triangle**. It is isosceles because the two legs have the same length. An isosceles right triangle is the same as a 45, 45, 90 triangle, and so the hypotenuse has length $x = 3\sqrt{2}$. This could be rewritten as $3\sqrt{2} = \sqrt{9}\sqrt{2} = \sqrt{9 \cdot 2} = \sqrt{18}$ to make it easier to compare to y.

(4) For the GRE, it is useful to know the following two special triangles:



Some students get a bit confused because there are variables in these pictures. We can simplify the pictures if we substitute a 1 in for the variables.



Notice that the sides of the 30, 60, 90 triangle are then 1, 2 and $\sqrt{3}$ and the sides of the 45, 45, 90 triangle are 1, 1 and $\sqrt{2}$. The variables in the first picture above just tell us that if we multiply one of the sides in the second picture by a number, then we have to multiply the other two sides by the same number. For example, instead of 1, 1 and $\sqrt{2}$, we can have 3, 3 and $3\sqrt{2}$ (here $s = 3$), or $\sqrt{2}$, $\sqrt{2}$, and 2 (here $s = \sqrt{2}$).

21. If the degree measures of the three angles of a triangle are $50°$, $z°$, and $z°$, what is the value of z ?

A. 60
B. 65
C. 70
D. 75
E. 80

Solution by starting with choice C: Recall that a triangle has angle measures that sum to $180°$. Let us start with choice C and guess $z = 70$. Then the angle measures sum to $50 + z + z = 50 + 70 + 70 = 190$ degrees, a bit too large. We can therefore eliminate choices C, D, and E.

Let us try choice B next. So we are guessing that $z = 65$. It follows that the angle measures sum to $50 + z + z = 50 + 65 + 65 = 180$ degrees. Since this is correct, the answer is choice B.

* **Algebraic solution:** Using the fact that the angle measures of a triangle sum to 180° we have

$$50 + z + z = 180$$
$$50 + 2z = 180$$
$$2z = 130$$
$$z = 65$$

Therefore, the answer is choice B.

22. The volume of a rectangular box is 2 cubic inches. If the width of the box is 4 inches and the height is $\frac{1}{4}$ inch, what is the length?

A. $\frac{1}{8}$ inch
B. $\frac{1}{4}$ inch
C. 1 inch
D. 2 inches
E. 4 inch

* The formula for the volume of a box is $V = \ell wh$. So we have

$$V = \ell wh$$
$$2 = \ell(4)(\tfrac{1}{4})$$
$$2 = \ell$$

Therefore, the answer is choice D.

Note: This problem can also be solved by starting with choice C. I leave the details of this solution to the reader.

23. In triangle CAT, the measure of angle C is 45° and the measure of angle A is between 10° and 40°. Which of the following could be the measure of angle T ? Indicate all such measures.

A. 80°
B. 90°
C. 100°
D. 110°
E. 120°
F. 130°
G. 140°

* The sum of the measures of angles C and A is between $45 + 10 = 55°$ and $45 + 40 = 85°$. It follows that the measure of angle T must be between $180 - 85 = 95°$ and $180 - 55 = 125°$. So the answers are choices C, D, and E.

Note: It is not entirely clear if the extreme values of $95°$ and $125°$ should be included as solutions. This is due to the ambiguity of the word "between."

In this question it doesn't matter because neither of those numbers appear as answer choices.

See problem 59 for more about this.

24. In the xy-plane, points A and B have coordinates $(3, -2)$ and $(-5,4)$, respectively. If point C is the midpoint of line segment AB, and C has coordinates (x, y), then what is the value of xy ?

* $(x, y) = \left(\frac{3-5}{2}, \frac{-2+4}{2}\right) = \left(\frac{-2}{2}, \frac{2}{2}\right) = (-1,1)$. So $xy = (-1)(1) = \mathbf{-1}$.

Note: We find the x-coordinate of the midpoint of AB by taking the average of the x-coordinates of A and B.

In this problem the x-coordinate of point A is 3 and the x-coordinate of point B is -5. It follows that the x-coordinate of the midpoint of AB is $\frac{3+(-5)}{2} = \frac{-2}{2} = -1$.

Similarly, we find the y-coordinate of the midpoint of AB by taking the average of the y-coordinates of A and B.

In this problem the y-coordinate of point A is -2 and the y-coordinate of point B is 4. It follows that the y-coordinate of the midpoint of AB is $\frac{-2+4}{2} = \frac{2}{2} = 1$.

LEVEL 1: DATA ANALYSIS

A menu lists 6 meals and 5 drinks.

25. Quantity A: The number of different meal-drink combinations
Quantity B: 11

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

* We will use the **counting principle** which says that if one event is followed by a second independent event, the number of possibilities is multiplied. So in this example, the number of meal-drink combinations is $6 \cdot 5 = 30$. Since 30 is greater than 11, the answer is A.

Remark: The 2 events here are "choosing a meal," and "choosing a drink."

Creating a list: If you are having trouble understanding why we multiply in this problem, try writing out your own list and it should become clear. So, for example, suppose that our six meal choices are chicken, beef, fish, pasta, salad, and soup. Suppose our five drink choices are water, juice, soda, coffee, and tea. Here is a beginning of the list of meal-drink combinations. See if you can finish this list:

Chicken and water
Chicken and juice
Chicken and soda
Chicken and coffee
Chicken and tea
Beef and water
Beef and juice……….

26. Quantity A: The average (arithmetic mean) of 26, 53, and 125
Quantity B: The average (arithmetic mean) of 25, 54, and 125

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

*** Quick solution:** Both Quantities have the same sum, and therefore the same average. So the answer is C.

Note: One of the numbers mentioned in Quantity B is 1 less than a number mentioned in Quantity A, and another number mentioned in Quantity B is 1 more than a different number mentioned in Quantity A. The third number is the same in each Quantity. It follows that the 3 numbers mentioned in Quantity A have the same sum as the 3 numbers mentioned in Quantity B. Since both Quantities have the same sum, and the same amount of numbers, the two averages are the same.

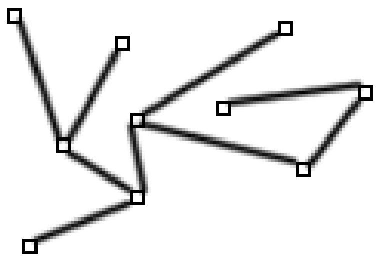
Computational solution: $\frac{26+53+125}{3} = \frac{204}{3} = 68$, $\frac{25+54+125}{3} = \frac{204}{3} = 68$, and therefore both Quantities are equal. So the answer is C.

Definition: The **average (arithmetic mean)** of a list of numbers is the sum of the numbers in the list divided by the quantity of the numbers in the list.

$$\textbf{Average} = \frac{\textbf{Sum}}{\textbf{Number}}$$

In GRE problems we sometimes use the formula in the following form:

$$\textbf{Sum} = \textbf{Average} \cdot \textbf{Number}$$



Each  represents a nail and each  represents a wire.

27. Quantity A: The number of nails
    Quantity B: The number of wires

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

*** Solution by counting:** There are 10 nails (represented by ) and there are 9 wires (represented by ). So Quantity A is greater than Quantity B, choice A.

$$\text{List } A\text{: } 35, 14, 63, 22, 53, 35$$

28. Quantity A: The median of the numbers in list *A*
    Quantity B: The mode of the numbers in list *A*

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

* Let's list the numbers in increasing order:

$$14, 22, 35, 35, 53, 63$$

It should now be easy to see that the median and mode are both 35, choice C.

Definitions: The **median** of a list of numbers is the middle number when the numbers are arranged in increasing order. If the total number of values in the list is even, then the median is the average of the two middle values.

The **mode** of a list of numbers is the number that occurs most frequently. There can be more than one mode if more than one number occurs with the greatest frequency.

29. The average (arithmetic mean) of three numbers is 100. If two of the numbers are 80 and 130, what is the third number?

    A. 70
    B. 80
    C. 90
    D. 100
    E. 110

*** Solution by changing the average to a sum:** We change the average to a sum using the formula

Sum = Average · Number

We are averaging 3 numbers so that the Number is 3. The Average is given to be 100. Therefore the Sum of the 3 numbers is $100 \cdot 3 = 300$. Since we know that two of the numbers are 80 and 130, the third number is $300 - 80 - 130 = 90$, choice C.

$$\text{List } A\text{: } 58, 35, 72, 46, 49$$
$$\text{List } B\text{: } 70, 53, 11, 20, 68$$

30. The median of the numbers in list B is how much greater than the median of the numbers in list A ?

A. 2
B. 4
C. 7
D. 7.6
E. 8

***** Let's rearrange the numbers in each list so that they appear in increasing order:

$$\text{List } A\text{: } 35, 46, \mathbf{49}, 58, 72$$
$$\text{List } B\text{: } 11, 20, \mathbf{53}, 68, 70$$

The median of the numbers in list B is 53 and the median of the numbers in list A is 49. So the answer is $53 - 49 = 4$, choice B.

31. For which of the following lists of 5 numbers is the average (arithmetic mean) less than the median? Indicate <u>all</u> such lists.

A. $1, 1, 3, 4, 4$
B. $1, 2, 3, 5, 6$
C. $1, 1, 3, 5, 5$
D. $1, 2, 3, 4, 5$
E. $1, 2, 3, 4, 4$
F. $1, 2, 3, 4, 9$

All of these lists have a median of 3.

It is very often easiest to work with the **Sum** of the numbers instead of the Average. We can easily change an average to a sum using the formula

Sum = Average · Number

In this case we want the sum to be less than $3 \cdot 5 = 15$. We check each choice:

A: $1 + 1 + 3 + 4 + 4 = \mathbf{13}$
B: $1 + 2 + 3 + 5 + 6 = 17$
C: $1 + 1 + 3 + 5 + 5 = 15$
D: $1 + 2 + 3 + 4 + 5 = 15$
E: $1 + 2 + 3 + 4 + 4 = \mathbf{14}$
F: $1 + 2 + 3 + 4 + 9 = 19$

The answers are choices A and E.

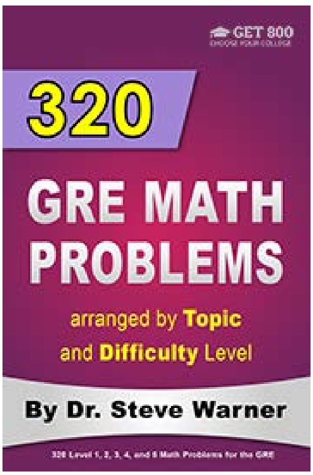
*** Quick Solution:** With a little experience it is not hard to see that A is an answer. Just look at how the numbers are "balanced" about the middle number 3. 1 is two units to the left, and 4 is only 1 unit to the right.

A similar argument can be used to see that choice E is an answer, and none of the other choices are answers.

So the answers are choices A and E.

$$9, 9, 9, 7, 7, 15, 11, x$$

32. The twelve numbers shown represent the weight, in pounds, of eight cats in a pet store. What is the median weight, in pounds, of



About the Author

Dr. Steve Warner, a New York native, earned his Ph.D. at Rutgers University in Pure Mathematics in May, 2001. While a graduate student, Dr. Warner won the TA Teaching Excellence Award.

After Rutgers, Dr. Warner joined the Penn State Mathematics Department as an Assistant Professor. In September, 2002, Dr. Warner returned to New York to accept an Assistant Professor position at Hofstra University. By September 2007, Dr. Warner had received tenure and was promoted to Associate Professor. He has taught undergraduate and graduate courses in Precalculus, Calculus, Linear Algebra, Differential Equations, Mathematical Logic, Set Theory and Abstract Algebra.

Over that time, Dr. Warner participated in a five year NSF grant, "The MSTP Project," to study and improve mathematics and science curriculum in poorly performing junior high schools. He also published several articles in scholarly journals, specifically on Mathematical Logic.

Dr. Warner has more than 15 years of experience in general math tutoring and tutoring for standardized tests such as the SAT, ACT and AP Calculus exams. He has tutored students both individually and in group settings.

In February, 2010 Dr. Warner released his first SAT prep book "The 32 Most Effective SAT Math Strategies," and in 2012 founded Get 800 Test Prep. Since then Dr. Warner has written books for the SAT, ACT, SAT Math Subject Tests and AP Calculus exams.

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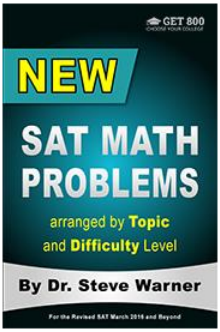

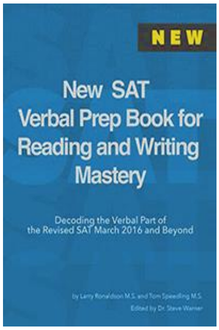

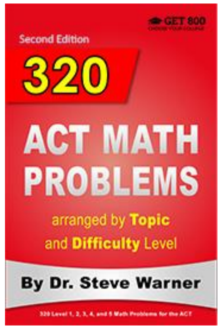

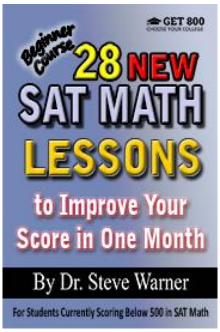

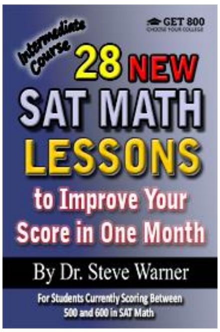

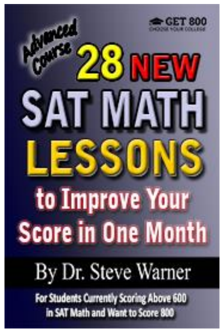

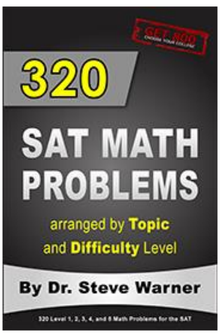

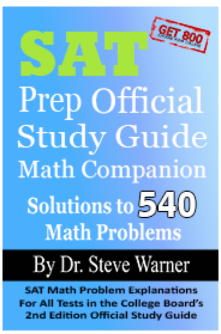

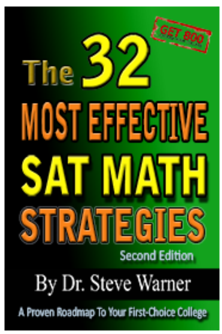

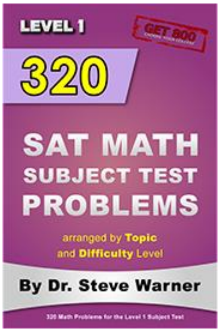

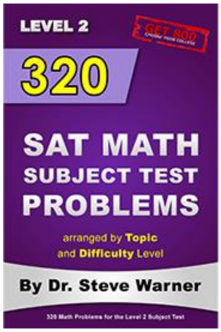

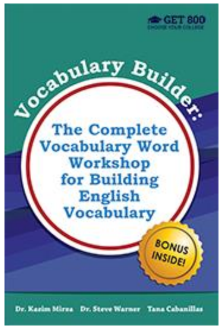

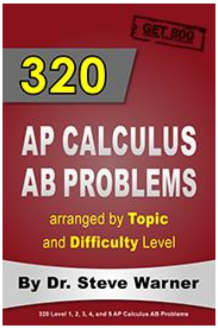

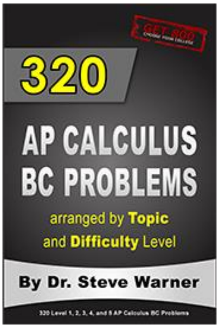

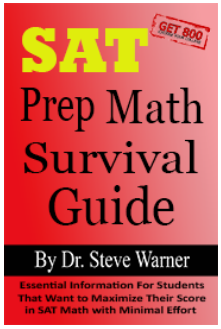

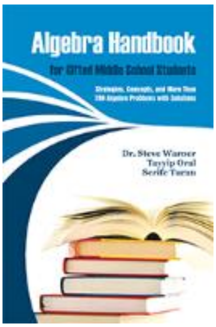

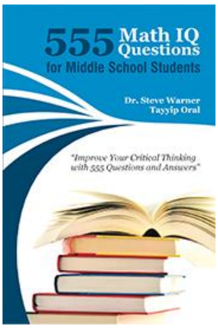

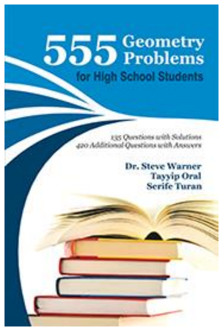

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