Question 1 Test 1, Second QR Section (version 3)
The list price of a certain tool is *x* dollars....
QA: The price in Store A QB: The price in Store B
Arithmetic: Percents Answer: *Quantity A is greater*

1. SUPPLY a number for *x*, the list price. Remember, when supplying a number for percent questions, supply 100.

   List price = *x* = $100

2. Now look at Store A:

   The original selling price (OSP) was $50 less than the list price (*x*)
   OSP = *x* – $50
   OSP = $100 – $50
   OSP = $50

   The current selling price (CSP) is 10% less than the original selling price (OSP)
   CSP = OSP – 10%(OSP)
   CSP = $50 – (0.10)($50)
   CSP = $50 – $5
   CSP = $45

3. Now look at Store B:

   The original selling price (OSP) was 10% less than the list price (*x*)
   OSP = *x* – 10%(*x*)
   OSP = $100 – (0.10)($100)
   OSP = $100 – $10
   OSP = $90

   The current selling price (CSP) is $50 less than the original selling price (OSP)
   CSP = OSP – $50
   CSP = $90 – $50
   CSP = $40

4. Compare the two quantities. Quantity A ($45) is greater than Quantity B ($40).

Question 2 Test 1, Second QR Section (version 3)
QA: Number of integers between 100 and 500.... QB: 36
Arithmetic: Sequences/Counting Problems Answer: *The two quantities are equal*

1. The easiest way to do this question is to figure out the number of multiples present in a range of 100 and then apply this knowledge to the entire range:

   $11 \times 9 = 99$, so there are 9 multiples of 11 in every range of 100
   There are 4 ranges of 100 (100 - 199, 200 - 299, 300 - 399, 400 - 499), so $4 \times 9 = 36$

2. Or you can use the formula for an arithmetic sequence to find the number of multiples:

   $a_n = a_1 + (n - 1)d$

   Where:
   a_1 = the first multiple of 11 in the range (110)
   a_n = the last multiple of 11 in the range (495)
   d = constant difference (11)
   n = number of multiples

   $a_n = a_1 + (n - 1)d$
   $495 = 110 + (n - 1)11$
   $495 = 110 + 11n - 11$
   $495 = 99 + 11n$
   $396 = 11n$
   $36 = n$ Compare Quantity A (36) to Quantity B (36). They are equal,

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Question 3 Test 1, Second QR Section (version 3)
***np* < ....**
QA: $|p + n|$ QB: $|p| + |n|$
Algebra: Absolute Value Answer: *Quantity B is greater*

1. SUPPLY numbers for n and p so that np is less than zero:

   $n = 2, p = -3$ $np = (2)(-3) = -6 < 0$

   Then plug n and p into the two absolute value expressions for each quantity

   Quantity A: $|p + n| \rightarrow |-3 + 2| \rightarrow |-1| \rightarrow 1$
   Quantity B: $|p| + |n| \rightarrow |-3| + |2| \rightarrow 3 + 2 \rightarrow 5$

   In this case—and in all cases—quantity B is greater. This is because the negative number that you supply in Quantity A will be reduce the positive number before the absolute value is applied. In Quantity B, the negative number has absolute value applied before being added to the positive number. Consider another example:

   $n = -10, p = 4$ $np = (-10)(4) = -40 < 0$
   Quantity A: $|p + n| \rightarrow |4 + -10| \rightarrow |-6| \rightarrow 6$
   Quantity B: $|p| + |n| \rightarrow |4| + |-10| \rightarrow 4 + 10 \rightarrow 14$

   Quantity A is always going to be the difference in their absolute values; Quantity B will always be the sum of their absolute values. So B will always be greater.

Question 4 Test 1, Second QR Section (version 3)
***a* and *b* are....**

QA: $\frac{a}{b}$ **QB:** $\frac{a+3}{b+3}$

Algebra: Expression/Number Properties Answer: *The relationship cannot be determined*

1. SUPPLY a set of numbers for *a* and *b* to determine the value of each quantity.

   If $a = 1$ and $b = 1$

   Quantity A = $\frac{a}{b} \rightarrow \frac{1}{1}$ or 1

   Quantity B = $\frac{a+3}{b+3} \rightarrow \frac{1+3}{1+3} \rightarrow \frac{4}{4}$ or 1 In this case, the two quantities are equal. This eliminates choice (A) and (B).

2. SUPPLY a second set of numbers for *a* and *b* to see if the result is the same.

   If $a = 1$ and $b = 2$

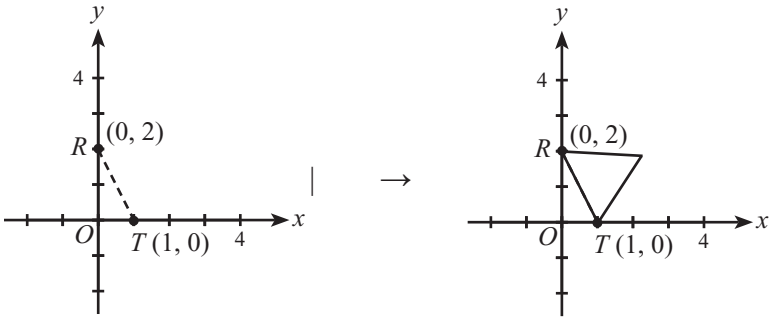
   Quantity A = $\frac{a}{b} \rightarrow \frac{1}{2}$ or 0.5

   Quantity B = $\frac{a+3}{b+3} \rightarrow \frac{1+3}{2+3} \rightarrow \frac{4}{5}$ or 0.8 In this case, Quantity A is greater.

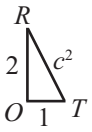
3. Since we have two possible answers, the relationship cannot be determined from the information given.

Question 5 Test 1, Second QR Section (version 3)
In the *xy*-coordinate plane, triangle *RST* is....
QA: Perimeter of *RST* QB: $3\sqrt{5}$
Coordinate Geometry: Triangles Answer: *The two quantities are equal*

1. DIAGRAM the question with a rough sketch of what the triangle might look like:



2. Because the triangle is an equilateral, all three sides will have the same measurement. We have the coordinates for side *RT* so we can compute its side length using the Pythagorean Theorem and triangle *RTO*:



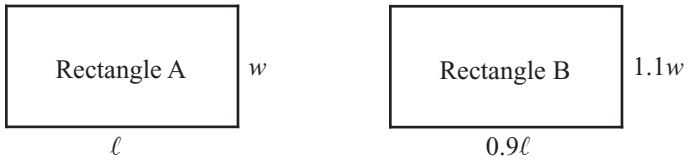
$a^2 + b^2 = c^2$
$2^2 + 1^2 = c^2$
$4 + 1 = c^2$
$5 = c^2$
$\sqrt{5} = c$

The perimeter of an equilateral triangle is side × 3, so the perimeter of RST is $\sqrt{5} \times 3$ or $3\sqrt{5}$.

3. The two quantities are equal.

Question 6 Test 1, Second QR Section (version 3)
The length of rectangle *B* is 10 percent less than...
QA: Area of *A* QB: Area of *B*
Geometry: Rectangles/Percents Answer: *The two quantities are equal*

1. DIAGRAM the question:



2. Now find the area for Rectangle A

   Area = $\ell + w \rightarrow \ell w$

   And Rectangle B:

   Area = $1.1\ell + 0.9w \rightarrow (0.99)\ell w$

3. Compare the quantities. The area of Rectangle A is greater than the area of Rectangle B.

4. You can also SUPPLY the length and width for Rectangle A in order to compute the length and width of both triangles. For example, if the length of Rectangle A = 20 and the width = 10, then the length of Rectangle B = 18 and the width = 11. The area of A is 200 and the area of B is 198. The only problem with this solution method is that some students may feel the need to supply a few sets of numbers to ensure the ratio is consistent.

Question 7 Test 1, Second QR Section (version 3)
$a < 0 < ....$
QA: a^{-10} QB: b^{-5}
Algebra: Exponents Answer: *The relationship cannot be determined*

1. SUPPLY numbers to satisfy $a < 0 < b$:

   If $a = -1$ and $b = 1$, then:

   $$a^{-10} \rightarrow \frac{1}{a^{10}} \rightarrow \frac{1}{-1^{10}} \rightarrow \frac{1}{1} \rightarrow 1$$

   $$b^{-5} \rightarrow \frac{1}{b^5} \rightarrow \frac{1}{1^5} \rightarrow \frac{1}{1} \rightarrow 1$$

   Right now, a and b are equal. But what if $a = -1$ and $b = 2$?

   $$b^{-5} \rightarrow \frac{1}{b^5} \rightarrow \frac{1}{2^5} \rightarrow \frac{1}{32} \rightarrow 0.03125$$

   Now Quantity A is greater than Quantity B. Therefore, the relationship cannot be determined from the information given.

Question 8 Test 1, Second QR Section (version 3)
USED CARS SOLD TABLE
For the 31 used cars sold last month...?
Data Analysis: Medians Answers: *$5,500, $6,500, $7,000*

1. There were 31 cars sold, so the median is the 16th car in order of price. The first 7 cars were under $5,500; the next 10 were between $5,000 and $7,499, so this means the 16th car cost somewhere between $5,000 and $7,499. The answer choices in this range are $5,500, $6,500, and $7,000.

Question 9 Test 1, Second QR Section (version 3)
If x is an integer, which of the following...?
Algebra: Number Properties Answer: $x^2 + 3x + 8$

1. SUPPLY $x = 1$ and plug it into each answer choice:

   A) $x^2 - x - 1 \rightarrow 1^2 - 1 - 1 \rightarrow 1 - 1 - 1 \rightarrow -1$ Odd

   B) $x^2 - 4x + 6 \rightarrow 1^2 - 4(1) + 6 \rightarrow 1 - 4 + 6 \rightarrow 3$ Odd

   C) $x^2 - 5x + 5 \rightarrow 1^2 - 5(1) + 5 \rightarrow 1 - 5 + 5 \rightarrow 1$ Odd

   D) $x^2 + 3x + 8 \rightarrow 1^2 + 3(1) + 8 \rightarrow 1 + 3 + 8 \rightarrow 12$ ✓

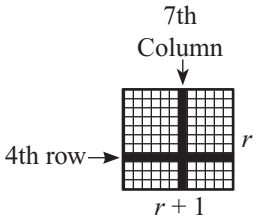
   E) $x^2 + 2x + 10 \rightarrow 1^2 + 2(1) + 10 \rightarrow 1 + 2 + 10 \rightarrow 13$ Odd

Question 10 Test 1, Second QR Section (version 3)
A rectangular game board is composed of identical squares....
Geometry: Creating Expressions Answer: $r^2 - r$

1. Start with number of squares on the entire board by multiplying the length by width:

   $(r + 1)(r) \quad \rightarrow \quad r^2 + r$

2. Now figure out the number of squares in the 4th row. A DIAGRAM might make this more clear:



   The 4th row has $r + 1$ squares. The 7th column has r squares. Together, these are the the squares not to be counted in the total:

   $(r + 1) + r \quad \rightarrow \quad 2r + 1$

   Notice that one of the squares is both in the 4th row and the 7th column and we are currently counting it twice. In order to count it only once, subtract 1 square:

   $2r + 1 - 1 \quad \rightarrow \quad 2r$

3. Now determine the number of squares on the board that are neither in the 4th row nor the 7th column:

   Total squares on the board minus the squares in the 4th row and 7th column =

   $r^2 + r \quad - \quad 2r$

   $r^2 + r - 2r \quad \rightarrow \quad r^2 - r$

Question 11 Test 1, Second QR Section (version 3)
The Sun is approximately 1,400 million kilometers from the planet Saturn....
Arithmetic: Rates Answer: *80*

1. First, find the rate that the light travels per minute:

$$\frac{300,000 \text{ km}}{1 \text{ second}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} = \frac{18,000,000 \text{ km}}{1 \text{ minute}}$$

2. Notice that the question uses "1,400 million kilometers" instead of "1,400,000,000" kilometers. This makes calculations easier, so we need to abbreviate similarly:

$$\frac{18 \text{ million km}}{1 \text{ minute}}$$

3. Now compute the number of minutes it takes light to travel to Saturn:

$$\frac{18 \text{ million km}}{1 \text{ minute}} = \frac{1,400 \text{ million km}}{? \text{ minute}}$$

Cross multiply:

$$\frac{18 \text{ million km}}{1 \text{ minute}} \times \frac{1,400 \text{ million km}}{? \text{ minutes}}$$

(18 million km)(? minutes) = (1,400 million km)(1 minute)

$$? \text{ minutes} = \frac{1,400 \text{ million km}}{18 \text{ million km}}$$

? minutes = 77.77

3. The question asked for an approximate number, and the closest answer choice is 80.

Question 12 Test 1, Second QR Section (version 3)
What is the least integer *n* such that....
Algebra: Exponents and Inequalities Answer: *10*

1. This question is tricky only because students tend to misread it. It is asking for the smallest number that makes the inequality true. Start with the smallest answer choice (10) and BACKPLUG:

$$\frac{1}{2^{10}} < 0.001 \quad \rightarrow \quad \frac{1}{1024} < 0.001 \quad \rightarrow \quad 0.00097 < 0.001 \quad \text{True!}$$

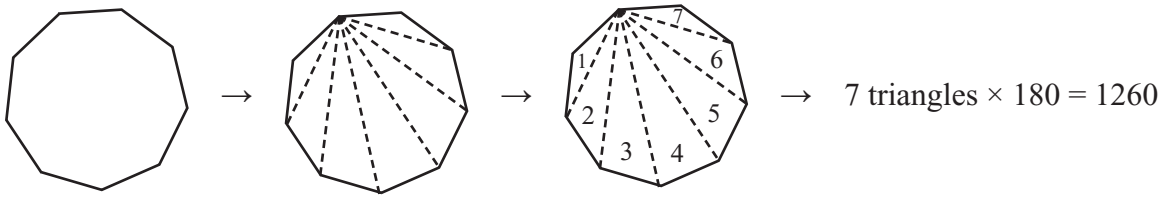
There is no need to test 11, 500, or 501 because the least integer listed worked.

Question 13 Test 1, Second QR Section (version 3)
The figure shows a regular 9-sided polygon....
Geometry: Polygons Answer: *40*

1. To find the sum of the interior angles of a polygon, use $180(n - 2)$, where n is the number of sides:

Sum of the interior angles = $180(9 - 2) \rightarrow 180(7) \rightarrow 1260°$

If you do not remember this formula, though, you can divide a polygon into triangles. Then count the triangles and multiply that number by 180:

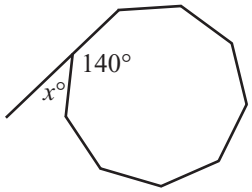


$\rightarrow$ 7 triangles × 180 = 1260

2. Since this 9-sided figure is regular, all of the interior angles are equal:

$1260° \div 9 = 140°$

3. Now we can find x:



$x° + 140° = 180°$
$x = 40°$

Question 14 Test 1, Second QR Section (version 3)
CORPORATE SUPPORT TABLE
How many of the six corporate sectors...?
Data Analysis: Percents Answer: *Three*

1. Start with 1988, and TRANSLATE to find the percentage:

$$\underline{\$60 \text{ million}} \ \underline{\text{is}} \ \underline{\text{what percent}} \ \underline{\text{of}} \ \underline{\$630 \text{ million}}?$$
$$\downarrow \quad \downarrow \quad \searrow \quad \downarrow \quad \downarrow$$
$$60 \quad = \quad \frac{?}{100} \quad \times \quad 630$$

$$60 = \frac{?}{100} \times 630$$
$$6000 = ? \times 630$$
$$9.52 = ?$$

Any sector that gave more than 9.52 percent in 1988 gave more than 60 million dollars. This included Services (17%), Manufacturing (31%), Retail (19%), and Other (20%).

2. Now find which sectors spent more than 60 million in 1991:

$$\underline{\$60 \text{ million}} \ \underline{\text{is}} \ \underline{\text{what percent}} \ \underline{\text{of}} \ \underline{\$520 \text{ million}}?$$
$$\downarrow \quad \downarrow \quad \searrow \quad \downarrow \quad \downarrow$$
$$60 \quad = \quad \frac{?}{100} \quad \times \quad 520$$

$$60 = \frac{?}{100} \times 520$$
$$6000 = ? \times 630$$
$$11.54 = ?$$

Any sector that gave more than 11.54 percent in 1991 gave more than 60 million dollars. This included Financial Insurance Real Estate (26%), Services (22%), Manufacturing (20%), and Other (18%).

3. Thus, three sectors gave more than 60 million in both years: Services, Manufacturing, and Other.

Question 15 Test 1, Second QR Section (version 3)
CORPORATE SUPPORT TABLES
From 1988 to 1991, which corporate sector decreased....?
Data Analysis: Percents Answer: *Manufacturing*

1. There are four sectors who decreased support from 1988 to 1991: Manufacturing, Retail, Wholesale, and Other. Two of these decreased their support by 9%: Manufacturing and Retail.

2. Compute the dollar amount for Manufacturing:

   1988: 31% of 630 million = 195.3 million
   1991: 20% of 520 million = 104 million

   Decrease = 195.3 – 104 = 91.3 million

3. Compute the dollar amount for Retail:

   1988: 19% of 630 million = 119.7 million
   1991: 8% of 520 million = 41.6 million

   Decrease =119.7– 41.6 = 78.1 million

4. Manufacturing decreased by 91.3 million while Retail only decreased by 78.1 million.

Question 16 Test 1, Second QR Section (version 3)
CORPORATE SUPPORT TABLE
The two corporate sectors that increased their support...?
Data Analysis: Percents Answer: *250*

1. The two sectors that increased their support were Financial, Insurance, Real Estate (from 5% to 26%) and Services (from 17% to 22%).

2. Find the contribution in 1991 of Financial, Insurance, Real Estate:

   1991: 26% of \$520 million → $0.26 \times 520 = \$135.2$ million

3. Find the contribution in 1991 of Services:

   1991: 22% of \$520 million → $0.22 \times 520 = \$114.4$ million

4. Calculate the total and find the answer choice that is an *approximate* value:

   $\$135.2 + \$114.4 = \$249.6$ → \$250 million

Question 17 Test 1, Second QR Section (version 3)
If $a \le b \le c \le d \le e \le 110$ and...?
Statistics: Average Answer: *60*

1. Plug the information provided (the average of *a, b, c, d,* and *e* is 100) into the average formula:

$$\frac{\text{sum}}{\text{\# of \#s}} = \text{average} \quad \rightarrow \quad \frac{\text{sum}}{5} = 100 \quad \rightarrow \quad \text{sum} = 500$$

2. In order for a to be a small as possible, *b, c, d,* and *e* must be as large as possible. Since all of them must be less than or equal to 110, 110 is the greatest possible value of *b, c, d,* and *e*:

$$a + b + c + d + e = 500 \quad \rightarrow \quad a + 110 + 110 + 110 + 110 = 500 \quad \rightarrow \quad a = 60$$

Question 18 Test 1, Second QR Section (version 3)
A car manufacturer produced a car at a cost of *d* dollars....
Arithmetic: Percents Answer: *1.38d*

1. This question is easily solved by SUPPLYING numbers. Remember, use \$100 when supplying a price for percent questions.

   $d = \$100$

   Sold to the dealer for 20% more: 20% of \$100 → $0.20 \times \$100$ → \$20 → \$100 + \$20 = \$120

   Sold to a consumer for 15% more: 15% of \$120 → $0.15 \times \$120$ → \$18 → \$120 + \$18 = \$138

2. Most students will recognize the last answer choice as being correct, but if not, plug $d = \$100$ into the five choices to find the one that produces \$138, the amount the car cost the consumer.

Question 19 Test 1, Second QR Section (version 3)
The function *f* is defined for all numbers *x* by $f(x) = x^2 + x$....
Algebra: Functions and Quadratics Answers: *–3 and 5/2*

1. Start by plugging $f(2t)$ into the function $f(x) = x^2 + x$:

$f(x) = x^2 + x$
$f(2t) = (2t)^2 + 2t$
$f(2t) = 4t^2 + 2t$ *(Be sure to distribute the exponent!)*

2. Now we have two quantities that equal $f(2t)$:

$f(2t) = 4t^2 + 2t$
$f(2t) = 30$

Set them equal to each other:

$4t^2 + 2t = 30$
$4t^2 + 2t - 30 = 0$ *Quadratic form!*
$2(2t^2 + t - 15) = 0$ *Divide both sides by 2.*
$2t^2 + t - 15 = 0$
$(2t - \ )(t + \ ) = 0$
$(2t - 5)(t + 3) = 0$
$(2t - 5) = 0$ and $(t + 3) = 0$
$t = 5/2$ and $t = -3$

Question 20 Test 1, Second QR Section (version 3)
A tailor used 30 buttons that had an average (arithmetic mean) weight of *x* grams....
Statistics: Combined Averages Answer: $\frac{3x}{5} + 32$

1. Start by finding the sum of the group of 30 buttons:

$$\frac{\text{sum}}{\#\text{ of }\#\text{s}} = \text{average} \quad \rightarrow \quad \frac{\text{sum}_1}{30} = x \quad \rightarrow \quad \text{sum}_1 = 30x$$

Then find the sum of the group of 20 buttons:

$$\frac{\text{sum}}{\#\text{ of }\#\text{s}} = \text{average} \quad \rightarrow \quad \frac{\text{sum}_2}{20} = 80 \quad \rightarrow \quad \text{sum}_2 = 1600$$

2. Now find the combined average:

$$\frac{\text{sum}_1 + \text{sum}_2}{(\#\text{ of }\#)_1 + (\#\text{ of }\#)_2} = \text{combined average} \quad \rightarrow \quad \frac{30x + 1600}{30 + 20} \quad \rightarrow \quad \frac{30x + 1600}{50} \quad \rightarrow$$

$$\frac{30x}{50} + \frac{1600}{50} \quad \rightarrow \quad \frac{3x}{5} + 32$$