SAT Advanced Math KEY
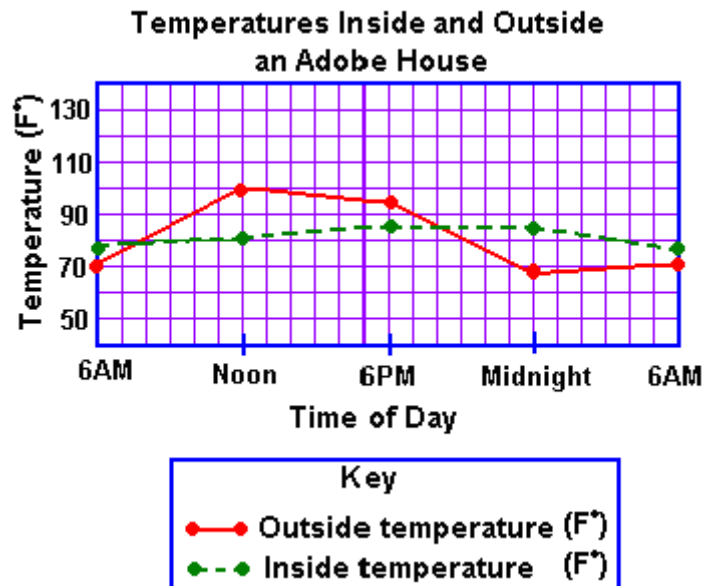
1. Which of the following statements is a reasonable conclusion based on the data in the graph below?

Temperatures Inside and Outside an Adobe House

The correct answer is a, The outside temperatures vary more than the inside temperatures.

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2. Which of the following describes the domain of $f(x) = \sqrt[3]{x+2}$

Since we are taking the third root, the value the radicand may be negative, zero, or positive.

The correct answer is d, all real numbers.

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3. The yearly salaries of 10 employees of a small company are:

$22,000	$58,000
$19,000	$18,000
$25,000	$21,000
$20,000	$75,000
$20,000	$23,000

Calculate the mean, mode and median. Which is the best measure of central tendency for this set of data?

Since the data set contains an outlier, $75,000, the median will be the best measure of central tendency. The median is the mean of the middle two values of the ordered data set, which is ($22.000 + $21,000)/2 = $21,500. The correct answer is b.

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4. Simplify: $(225)^{\frac{1}{2}}$

The exponent of $\dfrac{1}{2}$ represents a square root. The square root of 225 is 15. The correct answer is d, 15.

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5. Simplify: $\left(\dfrac{4}{15}\right)^{-2}$

When a fraction is raised to a negative exponent, the fraction is inverted and the exponent will become positive. Both the new numerator of 15 and the new denominator of 4 will be raised to the power of 2. The correct answer is a, $\left(\dfrac{225}{16}\right)$.

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6. Solve: $\sqrt[3]{x-5} = -4$

To solve, cube both sides of the equation. Then x – 5 = – 64. Solving for x, x = – 59. The correct answer is c.

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7. Find the union and intersection of sets A and B:

$$A = \{3, 5, 6, 12, 27\} \quad B = \{3, 5, 11, 17, 19\}$$

The union contains elements that belong to one set or the other. The union is {3, 5, 6, 11, 12, 17, 19, 27}. The intersection contains elements that belong to both sets. The intersection is (3, 5}. The correct answer is c.

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8. Solve: | 6x – 3 | = 33

Let 6x – 3 = 33	and	6x – 3 = –33
6x = 36		6x = –30
x = 6		x = –5

The correct answer is c, {–5, 6}.

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9. Solve: $\dfrac{x+6}{5} - \dfrac{x-6}{7} = 5$

Since this is an equation, multiply through by the least common denominator (LCD). The LCD is 35.

$$35\left(\frac{x+6}{5} - \frac{(x-6)}{7} \right) = 5(35)$$

$$7x + 42 - [5x - 30] = 175$$
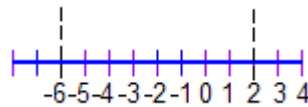
$$7x + 42 - 5x + 30 = 175$$

$$2x + 72 = 175$$

$$2x = 103$$

$$x = 51.5$$

The correct answer is b.

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10. Solve the inequality $\dfrac{x+6}{x-2} \le 0$

Since $x = 2$ is undefined and when $x = -6$, the left side equals zero, we use these two points to test regions on the number line.

-6-5-4-3-2-1 0 1 2 3 4

| test –7 | test 0 | test 4 |

$$\frac{-7+6}{-7-2} \le 0 \qquad\qquad \frac{0+6}{0-2} \le 0 \qquad\qquad \frac{4+6}{4-2} \le 0$$

$$\frac{-1}{-9} \le 0 \text{ false} \qquad\qquad \frac{6}{-2} \le 0 \text{ true} \qquad\qquad \frac{10}{2} \le 0 \text{ false}$$

Values in the center region, between –6 and 2 will work in the original inequality. The value –6 will work, but the inequality is undefined when $x = 2$. The correct answer is d, $[-6, 2)$.

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11. Evaluate f(4) for the function $f(x) = x^2 + 5x - 18$.

$$f(4) = (4)^2 + 5(4) - 18$$

$$f(4) = 16 + 20 - 18$$

$$f(4) = 18$$

The correct answer is c, 18.

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12. What is the slope of the line $9x - 3y = 108$?

Since the equation is in standard form ($ax + by = c$), the slope is $\frac{-a}{b}$. The slope is $\frac{-9}{-3} = 3$. The correct answer is d, 3.

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13. As part of his retirement savings plan, Ben deposited $350 in a bank account during his first year in the workforce. During each subsequent year, he deposited $30 more than the previous year. Find how much he deposited during his twenty-fifth year in the workforce. Also, find the total amount deposited during the entire twenty-five years.

To find how much Ben deposited during his 25th year, use the formulas for a general term of an arithmetic sequence

$$a_n = a_1 + (n-1)d \qquad \rightarrow \qquad a_n = 350 + (25-1)30 = \$1070$$

So in the 25th year, Ben will be depositing $1070. To find the total amount deposited in the 25-year period, use

$$s_n = \frac{n(a_1 + a_n)}{2} \qquad \rightarrow \qquad s_n = \frac{25(350 + 1070)}{2} = \$17,750$$

The correct answer is b, $1070; $17,750

14. The scatterplot below compares the weights of bears with the neck sizes of bears. Based on the scatterplot, what can be concluded with certainty?
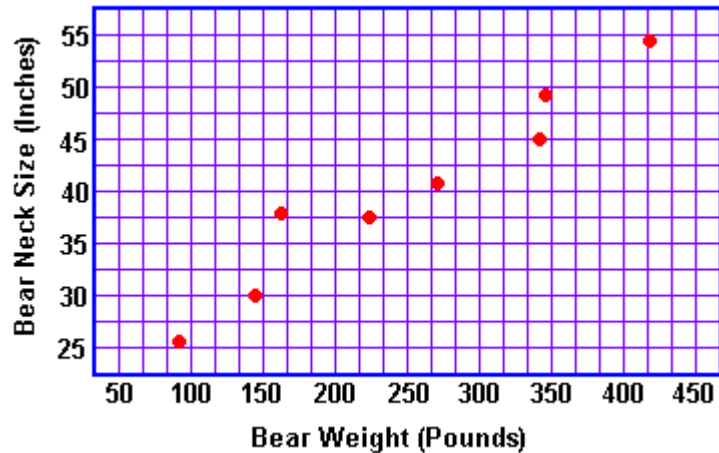
A causal relationship cannot be assumed, so choices a and b are ruled out. A relationship of correlation does exist, so choice d is ruled out. Choice e represents an incorrect interpretation of the scatterplot. The correct answer is c, A third factor such as age most likely causes both an increase in bear weight and in bear neck size.

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15. Use matrices to solve the following system.

1	2	0	6
7	3	1	−33
1	0	−1	16

1	2	0	6
0	−11	1	−75
0	−2	−1	10

−1 R1 + R3 = new R3

−7 R1 + R2 = new R2

1	2	0	6
0	1	$\frac{-1}{11}$	$\frac{75}{11}$
0	1	$\frac{1}{2}$	−5

R2 ÷ −11 and R3 ÷ −2

1	2	0	6
0	1	$\frac{-1}{11}$	$\frac{75}{11}$
0	0	$\frac{13}{22}$	$-\frac{130}{11}$

−1 R2 + R3 = new R3

1	2	0	6
0	1	$\frac{-1}{11}$	$\frac{75}{11}$
0	0	1	−20

R3 ÷ $\frac{13}{22}$ = new R3

$z = -20$

$y + \frac{-1}{11}(-20) = \frac{75}{11}$ $y = 5$

$x + 2(5) = 6$ $x = -4$

The correct answer is a, (−4, 5, −20).

16. Revenue is a function of the number of units sold. For the function $R(x) = 50x - 0.05x^2$, find the number of units that must be sold to maximize revenue.

To find the maximum number of units, find the x-coordinate of the vertex. Use $\dfrac{-b}{2a} = \dfrac{-50}{-2(0.05)} = 500$.
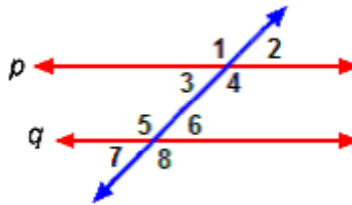
The correct answer is c, 500 units.

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17. For the portion of the graph shown, find the number of values of x for which $f(x) = 2$.
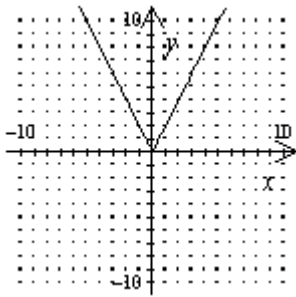
Find the values of x which correspond to the y-value of 2. There are two values, $x = \{1, -1\}$. The correct answer is c, 2.

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18. If p || q, which of the following is also true?

Angles 1 and 8 are alternate exterior angles and are therefore congruent. The correct answer is e, $\angle 1 \cong \angle 8$.

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19. Which of the following is a function?

Choices b and e do not pass the vertical line test. Choices c and d show repeating x values and therefore are not functions. A line having slope equal to 0 is a horizontal line and is therefore a function. The correct answer is a.

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20. Resistances wired in a parallel circuit are in a relationship described by $\dfrac{1}{r_{total}} = \dfrac{1}{r_1} + \dfrac{1}{r_2}$

The total resistance (r_{total}) of a circuit with two resistors wired in parallel is 40 ohms. Find the resistance of resistor two (r_2) if the resistance of r_1 = 60 ohms. By substitution, $\dfrac{1}{40} = \dfrac{1}{60} + \dfrac{1}{r_2}$.

Using the calculator, $\dfrac{1}{40} - \dfrac{1}{60} = \dfrac{1}{120}$.

Take the reciprocal of $\dfrac{1}{120}$ to solve for r_2. The correct answer is e, r_2 = 120 ohms.