

B-1. Evaluate:  $9 + 8 \times 1 - (5 - 2)! \times 2 + 1^0 \div 2 - 7$

- (A)  $-2$       (B)  $-1.5$       (C)  $2$       (D)  $3.5$       (E)  $4.5$

B-2. Larry Ett cut a 20 foot rope into three segments whose lengths have the ratio 2:4:5. How long was the segment that wasn't the shortest or the longest? (nearest inch)

- (A) 3'8"      (B) 5'0"      (C) 7'3"      (D) 9'1"      (E) 12'9"

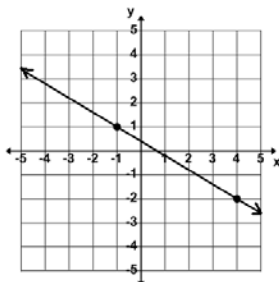
B-3. The head of *Border Farms* was given a "league" of land and a "labor" of land to farm. How many total acres was given for them to farm? (nearest integer)

- (A) 4,605 acres    (B) 5,065 acres    (C) 6,177 acres    (D) 7,618 acres    (E) 8,264 acres

A-4. If  $(4x - 1)^2 = ax^2 + bx + c$ , then  $a + b + c =$  \_\_\_\_\_.

- (A) 25      (B) 15      (C) 17      (D) 11      (E) 9

A-5. Find the slope of the line shown.



- (A)  $\frac{5}{3}$       (B)  $\frac{1}{5}$       (C)  $-\frac{1}{3}$       (D)  $-\frac{3}{5}$       (E)  $-1$

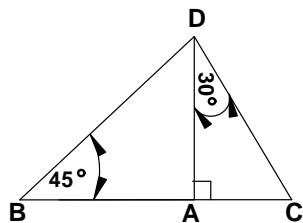
A-6.  $2 + (3 + 5) = 2 + (5 + 3)$  is an example of the \_\_\_\_\_ property of addition.

- (A) associative    (B) commutative    (C) distributive    (D) identity    (E) inverse

G-7.  $\triangle PQR$  is a right triangle and  $\overline{PS}$  is the altitude to the hypotenuse. Which of the following angles are complementary to  $\angle PQR$ ?

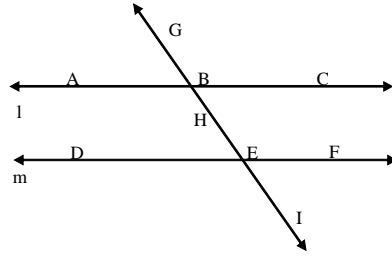
- (A)  $\angle PSR$       (B)  $\angle PSQ$       (C)  $\angle QPR$       (D)  $\angle SPR$       (E)  $\angle SPQ$

G-8. Find the perimeter of  $\triangle BCD$  if  $CD = 4''$ . (nearest tenth)



- (A) 17.8"      (B) 15.8"      (C) 14.4"      (D) 12.3"      (E) 11.8"

G-9. The three lines in the figure are coplanar with  $m \parallel l$ .  
Which of the following are false statements?



1.  $\angle ABG$  &  $\angle FEI$  are supplementary    2.  $m\angle BED = m\angle CBE$   
3.  $\angle CBH \cong \angle FEH$     4.  $\angle DEH$  &  $\angle FEH$  are vertical angles

- (A) 2 only    (B) 1 & 2    (C) 3, & 4    (D) 1, 3, & 4    (E) 1, 2, 3, & 4

A2-10. The roots of  $x^3 - 2x^2 - 5x + 6 = 0$  are p, q, and r. Find  $(p + q)(q + r)(p + r)$ .

- (A) 2    (B) -1    (C) -4    (D) -16    (E) -28

A2-11. Let  $A = \begin{bmatrix} 7 & 5 \\ -2 & -1 \end{bmatrix}$  and  $B = \begin{bmatrix} 7 & -2 \\ 5 & -1 \end{bmatrix}$ . If  $AB = \begin{bmatrix} d & e \\ f & g \end{bmatrix}$  then  $d + g = ?$ .

- (A) 79    (B) 41    (C) 38    (D) 33    (E) 18

A2-12. If  $a_1 = -2$ ,  $a_2 = -1$  and  $a_n = (a_{n-2} - a_{n-1})(a_{n-1})$ , where  $n \geq 3$ , then  $a_6$  equals:

- (A) -30    (B) -24    (C) -12    (D) -6    (E) -2

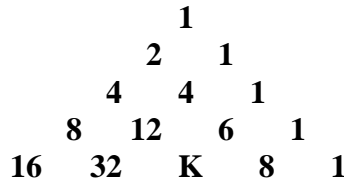
T-13. Determine the range of  $f(x) = 5\sin[4(x + \frac{\pi}{3})] - 2$ .

- (A)  $[-7, 3]$     (B)  $[-5, -2]$     (C)  $[-7, 5]$     (D)  $[-3, 3]$     (E)  $[-8, 4]$

T-14. The expression  $\frac{\cos \theta}{\sec \theta} - \frac{\sin \theta}{\csc \theta}$  is equivalent to:

- (A) -1    (B) 0    (C) 1    (D)  $\sin 2\theta$     (E)  $\cos 2\theta$

An-15. Find K if the triangular pattern shown below continues.



- (A) 30    (B) 28    (C) 24    (D) 20    (E) 16

An-16. Given the geometric sequence  $20\frac{1}{4}, a, b, c, d, 85\frac{1}{3}, \dots$ . find  $a + b + c + d$ .

- (A)  $105\frac{7}{12}$     (B) 121    (C)  $154\frac{3}{4}$     (D) 175    (E) 280

An-17. The harmonic mean of the roots of  $x^4 - 14x^3 + 67x^2 - 126x + 72 = 0$  is:

- (A)  $2\frac{2}{7}$       (B)  $1\frac{5}{7}$       (C)  $2\frac{3}{14}$       (D)  $3\frac{7}{36}$       (E)  $4\frac{2}{67}$

C-18. Let  $f(x) = 2x^2 + 3x - 4$  and  $g(x) = 5x - 1$ . Find  $g(f'(1))$ .

- (A) 4      (B) 34      (C) 7      (D) 36      (E) 61

C-19. The area under the curve  $y = \cos x$  from  $x = k$  to  $x = \frac{\pi}{2}$  is 0.1. Find  $k$  to the nearest hundredth, where  $0 \leq k < \frac{\pi}{2}$ . new one from a,b calculus test problems

- (A) 0.44      (B) 1.12      (C) 1.28      (D) 25.21      (E) 64.16

P-20. Roland Bones rolls a pair of dice. What is the probability that the sum of the top faces he rolls is a prime number?

- (A)  $\frac{5}{7}$       (B)  $\frac{5}{36}$       (C)  $\frac{7}{9}$       (D)  $\frac{1}{2}$       (E)  $\frac{5}{12}$

P-21. How many distinct 4-letter code words can be made from the letters in the words "MATH TEST"?

- (A) 500      (B) 420      (C) 360      (D) 140      (E) 120

Misc-22. Polynomial equations with integer coefficients and only integer solutions are known as \_\_\_\_\_ equations.

- (A) Archimedian      (B) Boolean      (C) Mersenne      (D) Mandelbrot      (E) Diophantine

Misc-23. The number 60 is considered to be a "polite" number. The "politeness" of 60 is \_\_\_\_.

- (A) 6      (B) 5      (C) 4      (D) 3      (E) 2

Misc-24. Which of the following is a Fibonacci number?

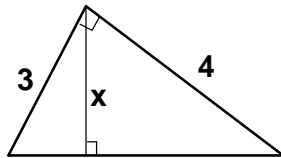
- (A) 231      (B) 378      (C) 610      (D) 721      (E) 980

Misc-25.  $123_4 + 456_8 = \underline{\hspace{2cm}}_2$ .

- (A) 101111101      (B) 101001001      (C) 100100101      (D) 101111001      (E) 100101110

## Fill in the blanks

- FB-26. Millie Watt works for an electric company. She knows that the length of a wire varies directly with the weight of the wire. She weighs 20 feet of wire and finds that it weighs 4 pounds. How long would a roll of wire be if it weighs 50 pounds? \_\_\_\_\_ feet
- FB-27. The Roland Dough Pizzeria requires some good math skills to get the order correct. Two large pizzas plus one medium pizza costs the same as eight small pizzas. One large pizza costs the same as one medium and one small. How many small pizzas can you buy for the price of a large pizza? \_\_\_\_\_ small pizzas
- FB-28. Suppose the radius of an expanding sphere is expanding at a rate of 1 inch/min. What is the rate the volume is changing with respect to time when the radius is 5 in. (nearest whole number) \_\_\_\_\_ in<sup>3</sup>/min
- FB-29. How many digits,  $d$ , exist such that  $d! + 1$  is a perfect square? \_\_\_\_\_
- FB-30. Find  $x$ .



$x =$  \_\_\_\_\_

### Mathematicians (no new mathematicians this year)

Agnesi	Archimedes	Aryabhata	Bigollo, Leonardo Pisano
Boole, George	Byron, Ada (Lady Lovelace)		Cantor, Georg
Descartes, Rene	Diophantus	Erastosthenes	Euclid
Euler, Leonard	Germain, Sophie	Goldbach, Christian	Hypatia
Kovalevsky, Sonya	Leibniz, Gottfried	Mandelbrot, Benoit	Mersenne, Marin
Napier, John	Noether, Emmy	Porter, Freda	Ptolemy, Claudius
Smith, Karen E.	Stott, Alicia	Theano	Turing, Alan
Venn, John	Vieta, Franciscus	Williams, Grace	Zeno of Elea

### Types of Numbers (no new types of numbers this year)

Complex	Real	Imaginary	Rational	Irrational
Transcendental	Integer	Whole	Natural	Even
Odd	Prime	Composite	Unit	Deficient
Frugal	Economical	Perfect	Equidigital	Abundant
Extravagant	Wasteful	Fibonacci	Lucas	Happy
Unhappy	Lucky	Unlucky	Evil	Odious
Germain Primes	Mersenne Primes	Polite	Primeval	Harmonic
Vampire	Tetrahedral	Emirp Prime		