A+ MS/JH Mathematics

A Test Writer's Perspective

Andy Zapata

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- Married
- 4 children
- 3 grandchildren
- Classroom Teacher 42 years
- Co-founder Texas Math and Science Coaches Association (TMSCA)
- Azle Junior High – (1974 – 1982)
- Azle High School – (1982 – 2016)
- Physics teacher (1982 – 2016)
- AP Physics reader – (2004 – 2016)
- AISD Grant Writer – (2017)
- High School Aerospace Scholar counselor – (2006 – 2010)
- Coached – JH slide rule (1974 – 1982)
  HS - slide rule, number sense, calculator applications, mathematics, science (1982 – 2016)
- Coached numerous high school state champions and state championship teams.
- Azle HS UIL academic coordinator
- 2001 – 2002 UIL sponsor excellence award winner
- UIL A+ Number Sense, Calculator, Mathematics consultant (2007 – present)

Middle School Mathematics

Students begin taking math in elementary school and continue taking it in high school. Learning to complete math problems quickly is a valuable skill in all facets of life including engineering, accounting, completing a tax return and even grocery shopping. This contest includes problems covering, but not limited to numeration systems, arithmetic operations involving whole numbers, decimals, exponents, order of operations, probability, statistics, number theory, simple interest, measurements and conversions.

Middle School Mathematics

Geometry and Algebra I problems may be included as appropriate for the grade level.

The contest, designed for students in grade 6, 7 and 8, consists of 50 multiple-choice problems.

Sample Mathematics Problems

(1) Which of the following has more than five sides?

A) pentagon

B) square

C) triangle

D) hexagon

E) rhombus

(D)

Sample Mathematics Problems

(2) What is the product of the prime numbers greater than 15 and less than 20?

A) 37
B) 323
C) 17
D) 19
E) None of these

$17 \times 19 =$

323 (B)

You should know your primes up to 100 !

Sample Mathematics Problems

(3) If the price of a barrel of oil drops from \$50 to \$45, then the percent decrease is:

A) 5%
B) 10%
C) 11 1/9%
D) 1/9 %
E) 0.1%

$$\%\ \text{decrease} = \frac{45 - 50}{50} \times \left(100\,\%\right)$$

% decrease = (– 10 %) (B)

Sample Mathematics Problems

(4) If one acute angle of a right triangle is 38°, then the other acute angle is:

A) 38°
B) 25°
C) 52°
D) 90°
E) 142°

Acute angles of right triangle sum to 90°.

90° – 38°

= 52° (C)

Sample Mathematics Problems

(5) At one point, Jerry is 110 feet behind Sheri. If Jerry is traveling at a speed of 45 miles per hour (mph) and Sheri is traveling at a speed of 30 mph, how long does it take Jerry to catch Sheri?

A) 5.0 sec

B) 15 sec.

C) 12.5 sec

D) 7 1/3 sec

E) 8 sec

Note: Special Conversion

$45 \text{ mph} \times \left(\frac{22}{15}\right) = 66 \text{ ft/s}$; $30 \text{ mph} \times \left(\frac{22}{15}\right) = 44 \text{ ft/s}$

$110 \text{ ft} \div (66 \text{ ft/s} - 44 \text{ ft/s}) =$ **5.0 s (A)**

Sample Mathematics Problems

(6) The equation $x^2 - 14x + 13 = 0$ has two roots (solutions). What is the solution with the largest magnitude?

A) 13
B) –14
C) 14
D) 1
E) –13

$x^2 - 14x + 13 = 0$

factors to

$(x - 13)(x - 1) = 0$

So, x = 13 or 1

Choose x = 13 (A)

Sample Mathematics Problems

(7) What is the remainder when you divide $(47^3 \times 12)$ by 5?

A) 3
B) 0
C) 2
D) 1
E) 4

47 ÷ 5 has remainder of 2. And $2^3 = 8$

And 8 ÷ 5 has a remainder of 3.

So, $47^3 \div 5$ has remainder of 3.

And 12 ÷ 5 has a remainder of 2.

Therefore: $(3 \times 2) \div 5$ has remainder of 1. (D)

Sample Mathematics Problems

(8) MMIX + MMVIII – MMM =

A) XVII
B) MMXV
C) MXIV
D) MMVII
E) MXVII

M = 1000; D = 500; C = 100; L = 50; X = 10; V = 5
I = 1

MMIX + MMVIII – MMM = 2009 + 2008 – 3000

= 1017

= MXVII (E)

Sample Mathematics Problems

(9) What is the shortest distance between the two points (- 3, 10) and (0, 6)?

A) 16

B) 25

C) 10

D) 6

E) 5

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$d = \sqrt{((-3) - 0)^2 + (10 - 6)^2}$$

$$d = \sqrt{(-3)^2 + (4)^2} \qquad = 5 \quad \textbf{(E)}$$

Sample Mathematics Problems

(10) 6 ¼ % = _____

A) 6 ¼
B) 3/8
C) 1/16
D) 25/4
E) ¼

6 ¼ % = 25/400 **= 1/16 (C)**

You should know your decimal and percent equivalences for 4ths, 5ths, 6ths, 7ths, 8ths, 9ths, 10ths, 11ths, 12ths, and 16ths !

Sample Mathematics Problems

(11) $143 \times 14 =$ _____

A) 2200
B) 2002
C) 202
D) 20002
E) 22000

Note that $\frac{1001}{7} = 143$; $\frac{2002}{7} = 286$; etc.

$143 \times 14 = \frac{1001}{7} \times \cancel{14}\ 2 = \mathbf{2002}$ **(B)**

Sample Mathematics Problems

(12) What is the length of a shadow of a 45-foot tree when a yardstick casts a shadow that measures 2 feet?

A) 60 ft

B) 90 ft

C) 30 ft

D) 55 ft

E) None of these

$$\frac{3\ ft}{2\ ft} = \frac{45\ ft}{x\ ft}$$

X = 30 ft (C)

Sample Mathematics Problems

(13) The sum of the 4th and 5th triangular numbers is _____

A) 9
B) 25
C) 50
D) 20
E) 12

The sum of the nth triangular number is: $\frac{n(n+1)}{2}$

$$\frac{4(4+1)}{2} + \frac{5(5+1)}{2} = 25 \quad \textbf{(B)}$$

Note that for the sum of two consecutive triangular numbers the SUM = $(n + 1)^2$.

Sample Mathematics Problems

(14) How many whole numbers will evenly divide into 24?

A) 48
B) 4
C) 5
D) 12
E) None of these

Factors of 24 : 1 & 24, 2 & 12, 3 & 8, 4 & 6 **= 8** **(E)**

OR

Prime Factor the number: $24 = 2^3 \times 3^1$

Add 1 to each exponent and multiply sums to get number of factors:

$(3 + 1) \times (1 + 1)$ **= 8** **(E)**

Sample Mathematics Problems

(15) If $2^{n+2} = 8$, then $2^n =$

A) 2

B) 4

C) 64

D) 16

E) 32

Note that in changing 2^{n+2} to 2^n we are subtracting 2 from the (n + 2)–exponent.

In order to subtract 2 from this exponent we need to divide by 2^2 or 4.

So, dividing both sides of the equation by 2^2 gives:

$8 \div 2^2 = 2$ **(A)**

Sample Mathematics Problems

(16) 4 Gallons + 12 Pints = _____ quarts

A) 18
B) 20
C) 22
D) 24
E) 30

Note: 1 gallon = 4 quarts **AND** Note: 1 quart = 2 pints

So, 4 gallons x 4 quarts/gallon = 16 quarts

AND 12 pints x 1 quart/2 pints = 6 quarts

16 quarts + 6 quarts = 22 (C)

Sample Mathematics Problems

(17) If two numbers differ by 4 and their sum is 14, what is the product of the two numbers?

A) 9
B) 45
C) 36
D) 56
E) 70

$x - y = 4$ $\qquad x + y = 14$

$2x = 18 \qquad \rightarrow x = 9$

AND $y = 5$

So, (9)(5) = **45** **(B)**

Sample Mathematics Problems

(18) If $x - y = 3$ and $x + y = 12$, then $x^2 - y^2 =$

A) 15
B) 9
C) 81
D) 36
E) 72

Recall: $x^2 - y^2 = (x - y)(x + y) \rightarrow$ {Algebra I Concept}

So, $x^2 - y^2 = (3)(12)$

36 (D)

Sample Mathematics Problems

(19) The mean (average) of a set of six numbers is 10. If the number 25 is removed from the set, what is the mean of the remaining numbers?

A) 6
B) 7
C) 8
D) 9
E) 10

$(x_1 + x_2 + x_3 + x_4 + x_5 + x_6)/6 = 10$

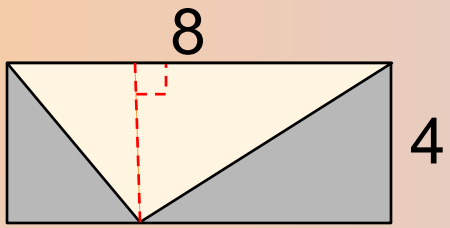
$(x_1 + x_2 + x_3 + x_4 + x_5 + x_6) = 60$

$(x_1 + x_2 + x_3 + x_4 + x_5) = 60 - 25 = 35$

So, mean of $x_1 + x_2 + \ldots x_5$ is $35 \div 5 =$ **7** **(B)**

Sample Mathematics Problems

(20) The rectangle shown below has side lengths of 8 and 4. What is the area of the shaded part?



A) 4
B) 12
C) 16
D) 32
E) 64

$A_{rect} = (8)(4) = 32$

$A_{trian} = (1/2)(8)(4) = 16$

So, $A_{shad} = 32 - 16 =$ **16** **(C)**

Sample Mathematics Problems

(1) What is the sum of the two largest prime numbers less than 50?

(2) The sum of the 14^{th} and 15^{th} triangular numbers is

(3) What is the length of a shadow of a 15-foot tree when a yardstick casts a shadow that measures 4 feet?

(4) 31 ¼ % = _____ fraction

(5) What is the shortest distance between the two points (–7, –6) and (5, 6)?

(6) How many whole numbers will evenly divide into 120?

Answers: 90; 225; 20; 5/16; 13; 16

Mathematics Resources

A+ Academics Resources

This is a list of independent companies who advertise preparatory materials for UIL elementary and junior high academic contests. **The University Interscholastic League is not affiliated with any of the companies and cannot be responsible for any of their products or services.**

Some Resources

MRC Jr.

- Jamie Pennington
- 412 Paradise Canyon Circle, Paradise, TX 76073
- Phone: 817-403-0669
- Website: www.uiltests.com
- Email: info@uiltests.com

Offers study materials and tests for Maps, Graphs and Charts, Dictionary Skills, 5/6 and 7/8 Social Studies, Science I, Science II, Number Sense and Mathematics.

Some Resources

Dr. Numsen/Doug Ray

- PO Box 312578, New Braunfels, Tx 78131
- Phone: 512-797-2158; Fax: 208-575-9617
- Email: doug@academicmeet.com
- Web site: www.academicmeet.com

Provides workbooks and practice tests for elementary and junior high Number Sense, Calculator Applications and Mathematics.

Some Resources

Leo Ramirez

- 9801 W. Parmer Lane #2622, Austin, Tx 78717
- Phone: 956-491-3155
- Email: toywiz127@aol.com
- Website: www.rammaterials.com/

Number Sense, Calculator Applications, Mathematics, and Science Workbooks (including Number Sense: A Starter's Kit, Middle School Magic, Number Sense Magic, Revised Calculator Applications workbook), DVDs and practice tests.

Some Resources

TMSCA Test Pool

- Texas Math/Sciences Coaches Association
- PO Box 206, Olney, Tx, 76374
- Phone: 940-563-1005; Fax: 940-563-1006
- Email: execsectmsca@gmail.com
- Web: www.tmsca.org

Offers study materials for math, number sense, calculator and science contests.

Some Resources

Number Dojo

- Website: www.NumberDojo.com
- Email: numdojo@gmail.com
- Facebook: www.facebook.com/numberdojo

Free resources include the Number Dojo iPhone app, Number Sensei blog with over 100 concepts and free worksheets, Mathing Bee contest info, and contest maps listing information for all published number sense meets. Also flash cards, worksheets, curriculum and concept reference indexes (solution manuals) for purchase.

Some Resources

The Virtual Challenge High School & Middle School Meets

- Owner/Director: Chuck Thompson
- Email: cthompson1313@gmail.com
- Phone: 940-782-9898
- Website: www.virtualchallengemeets.com

Offers a statewide testing program for the following contests for grades 9 – 12: Number Sense, Calculator, Mathematics, Science, Current Events, Social Studies, Literary Criticism, Spelling, Computer Science, Accounting.

- For grades 5-8: Number Sense, Calculator, Listening, Mathematics, Science I and II, Dictionary Skills, Maps, Graphs & Charts, Social Studies, and Spelling.
- The High School & Middle School Virtual Challenge Meets allow your team to compete in a season of 3 meets to prepare students for their UIL District Meet.
- Your combined elementary/middle school teams will enjoy unlimited entries in 16 different events in all 3 meets with no travel costs and all testing done on a customized schedule, all for one inexpensive combined Entry Fee.

Last year at the HS level, over 350 schools participated posting over 21,000 scores.