

Name _____

Tie Breaker: Points scored on Stated and Geometry Problems
 + _____ + _____ + _____

5x (Last Problem Attempted)	+	_____	+	_____	+	_____
7x (Number Incorrect)	-	_____	-	_____	-	_____
2x (Number Incorrect SDs)	-	_____	-	_____	-	_____
TOTAL SCORE		_____		_____		_____

UIL Calculator Applications

Test 10B

(Invitational B)

DO NOT OPEN THE TEST UNTIL INSTRUCTED TO BEGIN

- I. Calculator Applications rules and scoring—See UIL Constitution
- II. How to write the answers

A. For all problems except stated problems as noted below—write three significant digits.

1. Examples (* means correct but not recommended)

Correct: 12.3, 123, 123.*, 1.23x10*, 1.23x10^{0*}
 1.23x10¹, 1.23x10⁰¹, .0190, 0.0190, 1.90x10⁻²

Incorrect: 12.30, 123.0, 1.23(10)², 1.23·10², 1.230x10²,
 1.23*10², 0.19, 1.9x10⁻², 19.0x10⁻³, 1.90E-02

2. Plus or minus one digit error in the third significant digit is permitted.

B. For stated problems

1. Except for integer, dollar sign, and significant digit problems, as detailed below, answers to stated problems should be written with three significant digits.

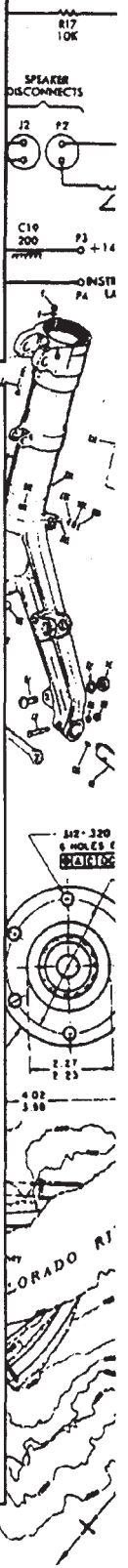
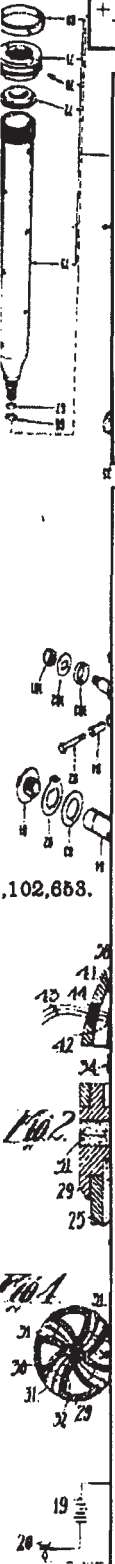
2. Integer problems are indicated by (integer) in the answer blank. Integer problems answers must be exact, no plus or minus one digit, no decimal point or scientific notation.

3. Dollar sign (\$) problems should be answered to the exact cent, but plus or minus one cent error is permitted. Answers must be in fixed notation. The decimal point and cents are required for exact-dollar answers.

4. Significant digit problems are indicated by underlined numbers and by (SD) in the answer blank. See the UIL Constitution and Contest Manual for details.

III. Some symbols used on the test

- A. Angle measure: rad means radians; deg means degrees.
- B. Inverse trigonometric functions: arcsin for inverse sine, etc.
- C. Special numbers: π for 3.14159 ...; e for 2.71828 ...
- D. Logarithms: Log means common (base 10); Ln means natural (base e); exp(u) means e^u.



10B-1. $0.451 + 0.0867 - 2.47$ ----- 1= _____

10B-2. $(84.5 + 37.7 - 15.6) \times 51.5$ ----- 2= _____

10B-3. $\frac{(0.286)(-0.997)(-0.416)}{-0.197} + 0.362$ ----- 3= _____

10B-4. $\{(-15.2)(0.941 + \pi - 1.34)(99.3)\} + 1240$ ----- 4= _____

10B-5. $\frac{(-0.00909 - 0.00632)(-8.92)}{\{(5.64)/(-6.8)\}} - (-0.25 - 0.0386)$ ----- 5= _____

10B-6. What is the square root of the sum of 95 and 149? ----- 6= _____

10B-7. What number plus 6 equals three times the number? ----- 7= _____

10B-8. How far does light travel in 1 nanosecond if it travels at 186,000 miles per second? ----- 8= _____ meter

10B-9.

PARALLELOGRAM

Area = 158

10B-9 = _____

10B-10.

CIRCLE

Circumference = 101

10B-10 = _____

10B-11. $\frac{(2720 + 2090)}{(0.671 - 0.702)} + \frac{(-87200 + 1.05 \times 10^5)}{(8.47 - 5.22)}$ ----- 11= _____

10B-12. $\frac{-0.672(2.84 \times 10^{-5} + 1.19 \times 10^{-5})}{(114 - 207)(-0.488)} - \frac{-3.24 \times 10^{-9}}{0.751 - 0.571}$ ----- 12= _____

10B-13. $\frac{-60900 + 21600 - 33300 + 9370 + 25900}{(-0.547)(56.8 + 47.6)(0.0941 + 0.0932)}$ ----- 13= _____

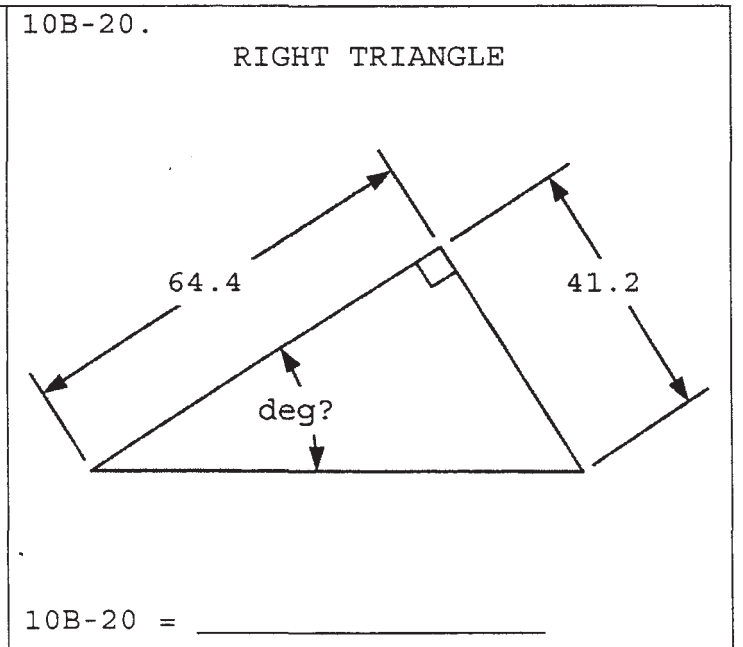
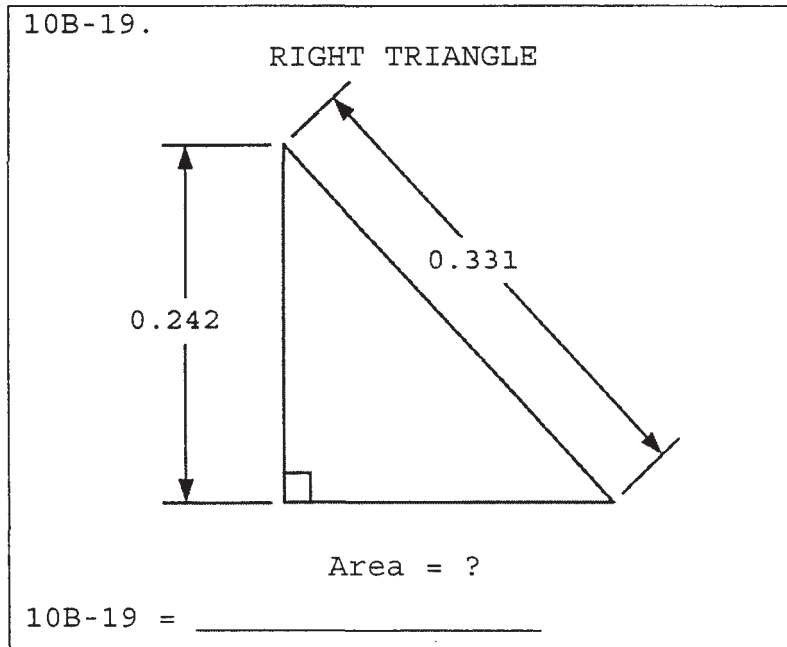
10B-14. $\frac{(25 + 18.3)(1.72 + 2.55)(52.2 - 187)}{(-0.303 + 0.113)(0.16)\{(-0.425)/(-0.669)\}}$ ----- 14= _____

10B-15. $\frac{3180 + 35100 - (17800 + 33100)(2.86 - 2.42)}{(-141)(0.403)(6.64)(540 - 262 + 593)}$ ----- 15= _____

10B-16. The product of three, consecutive integers is 2,048,256. What is the value of the middle integer? ----- 16= _____ integer

10B-17. Hana wants to make 108 CDs. If she does it herself, each CD costs \$1.58. She can have it done by a CD company for \$0.55 each, but the minimum order is 300 CDs. If she selects the option with smaller total cost, how much does she pay for the CDs? ----- 17= \$ _____

10B-18. In 2009, what was the total cost to an employer to hire a person full time at minimum wage for one year? Minimum wage was \$7.25/hr with an 8-hr day and 260 work days per year. The employer must allocate 26% of wages for tax, Social Security and vacation/sick leave. Finally, the employer must allocate an additional 52% of all costs for "overhead" (providing a desk, air conditioning, etc.). ----- 18= \$ _____



10B-21. $\left[\frac{(0.388)(0.901)}{-2.51} + 0.0642 \right]^2 + \sqrt{3.99 \times 10^{-6}}$ ----- 21= _____

10B-22. $\sqrt{\frac{(1.61)(7.65)}{802 + 183}} + 0.0923$ ----- 22= _____

10B-23. $\frac{\sqrt{9.56 + 7.65 + (647)/(53.8)}}{83.1 + 62.4}$ ----- 23= _____

10B-24. $(-7.51)(-0.0837)\sqrt{(-0.929)^2/0.556} + 1/\sqrt{0.907 + 3.45}$ ----- 24= _____

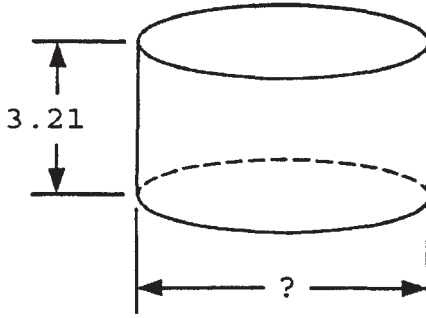
10B-25. $(-0.0095)(-119) + \sqrt{(0.343)/(\pi)} + [(0.14)(7.38)]^2$ ----- 25= _____

10B-26. It has been reported that the number of atoms in a 70 kg human body is 6.71×10^{27} . If Avogadro's Number is 6.022×10^{23} atoms/mole, what is the average molecular weight (MW) of an atom in the human body? The average MW is the number of grams divided by the number of moles. ----- 26= _____ (SD)

10B-27. The Great Pyramid of Giza has a square base of 756 ft side length, is 455 ft tall, and was built using large limestone blocks. Each block was rectangular, 50 in by 50 in by 30 in. How many blocks are there in the Great Pyramid? Neglect chambers and passageways. ----- 27= _____

10B-28. How fast must a farmer drive a 35-ft wide tiller to till a 100 acre plot in 4 hours? Neglect the time required to turn around at the end of a row. ----- 28= _____ mph

10B-29. CYLINDER



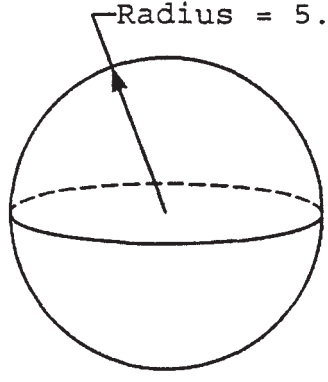
3.21

?

Volume = 95.8

10B-29 = _____

10B-30. SPHERE



Radius = 5.8

Surface Area = ?

10B-30 = _____

10B-31. $\frac{1}{0.00209} + \frac{1}{\sqrt{2.20 \times 10^{-5}}} + \frac{(\pi + 9.21 - 6.84)^2}{\sqrt{1.26 - 0.162}}$ ----- 31= _____

10B-32. $\frac{(0.00816 + 0.0161)^2}{\sqrt{25.5 - 21.4}} + \frac{1.77 \times 10^{-6}}{\sqrt{5.48 \times 10^{-4} + 8.53 \times 10^{-4}}}$ ----- 32= _____

10B-33. $\frac{(1.97 \times 10^5)^2 (7.41 \times 10^{-12} + 5.96 \times 10^{-12})}{90.5 + (-0.258)(590)} + \frac{1}{\frac{1}{-0.00427} + \frac{1}{(0.00642)}}$ ----- 33= _____

10B-34. $\frac{(\pi)^2 + \sqrt{1280}}{\sqrt{(877)(-16.9)^2}} + \frac{\sqrt{\sqrt{(24600)(0.7)}}}{-93.5 + 180}$ ----- 34= _____

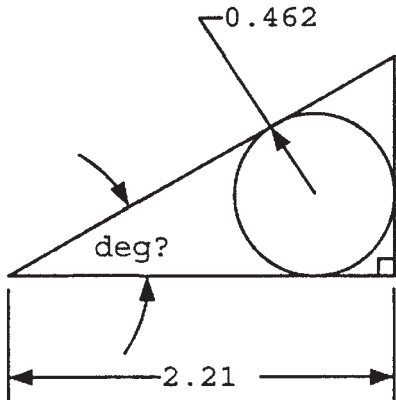
10B-35. $\frac{\frac{1}{-55.3} + \frac{-916}{(122 + 103)^2} - \frac{\sqrt{7.84 \times 10^7}}{(-701)^2}}{(104 + 126)^2 + (-79500)}$ ----- 35= _____

10B-36. What is $57,893^{453,562}$? ----- 36= _____

10B-37. A square has a perimeter of x meters and an area of x ft². What is the length of a side? ----- 37= _____ in

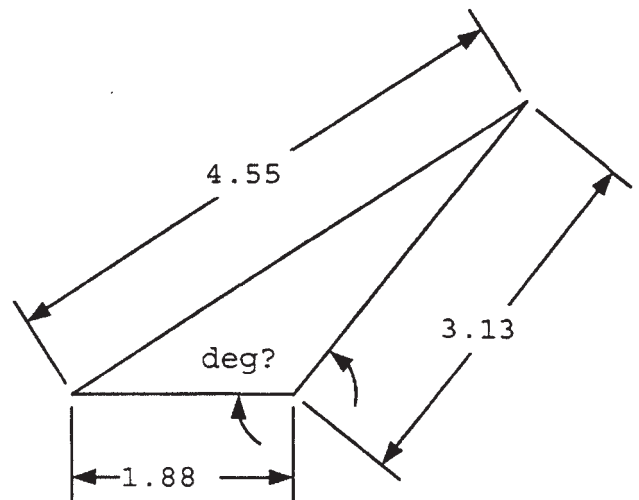
10B-38. An artilleryman fires a shell at an angle relative to the horizontal of 27 degrees. The shell reaches a maximum elevation of 68 ft but falls 40 ft short of the target. What new angle less than 45 degrees should the artilleryman use to hit the target on the second shot? ----- 38= _____ deg

10B-39. RIGHT TRIANGLE AND CIRCLE



10B-39 = _____

10B-40. SCALENE TRIANGLE



10B-40 = _____

10B-41. $\frac{10^{-(0.352 - 1.34)}}{-0.00266 + 0.00232}$ ----- 41= _____

10B-42. $3.98 \times 10^5 e^{0.389} + (1.71 \times 10^5) e^{-0.802}$ ----- 42= _____

10B-43. $\frac{0.505 - 2.37}{\text{Log}(0.452 + 0.0917)}$ ----- 43= _____

10B-44. $(1.72)^3 + (4.47 - 0.937)^{2.45}$ ----- 44= _____

10B-45. (deg) $\{(-7800) \sin(-62.8^\circ)\} \times \{(76700) \cos(-47.2^\circ)\}$ ----- 45= _____

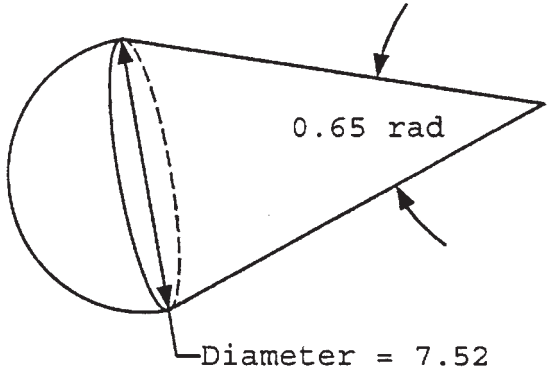
10B-46. Roger's average running speed uphill is inversely proportional to the grade. If he runs up a 3 mi long, 4° grade in 22 min, how long would it take to run up a 4 mi long, 6° grade? ----- 46= _____ min

10B-47. Moore's Law predicts that the number of transistors on a circuit board doubles every 2 years. In 1971, the count was 2300. In 1981 it was 100,000; in 1990 it was 1,000,000; in 2008 it was 1.5 billion. Based on these data, what is the actual time for doubling the number of transistors? ----- 47= _____ yr

10B-48. (rad) For what value of g between 0 and 1 does $[\cos(0.4\pi g)]^g = 0.75$? ----- 48= _____

10B-49.

CONE AND HEMISPHERE



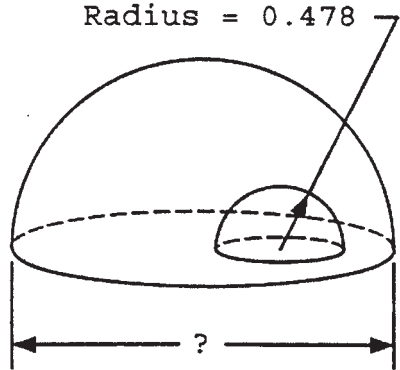
Diameter = 7.52

Total Volume = ?

10B-49 = _____

10B-50.

HEMISPHERE WITH
HEMISPHERICAL CAVITY



Radius = 0.478

Total Surface Area = 19.7

10B-50 = _____

10B-51. $10^{+(0.651)} + 10^{-(0.407)} + [10^{(0.603/0.581)} - 10^{(0.743)}]^{1/2}$ 51= _____

10B-52. $\frac{(-489 - 385) e^{(0.971)(3.27)}}{e^{-(1.16 - \pi)}}$ ----- 52= _____

10B-53. $\frac{\text{Ln}(60.2 + 180)}{25.8} + \frac{\text{Ln}(25.8)}{57 - 7.61}$ ----- 53= _____

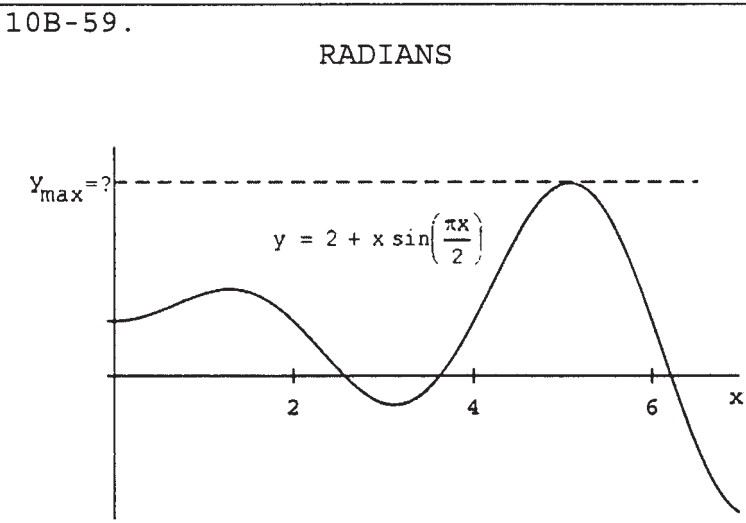
10B-54. $\frac{(-0.663 + 0.8)^{-0.398}}{(0.318)^{-(0.259 + 0.901)}}$ ----- 54= _____

10B-55. (rad) $\frac{\arcsin\{(-9.47)(-39.2)/(412)\}}{20.9 + (-2.29)(-40)}$ ----- 55= _____

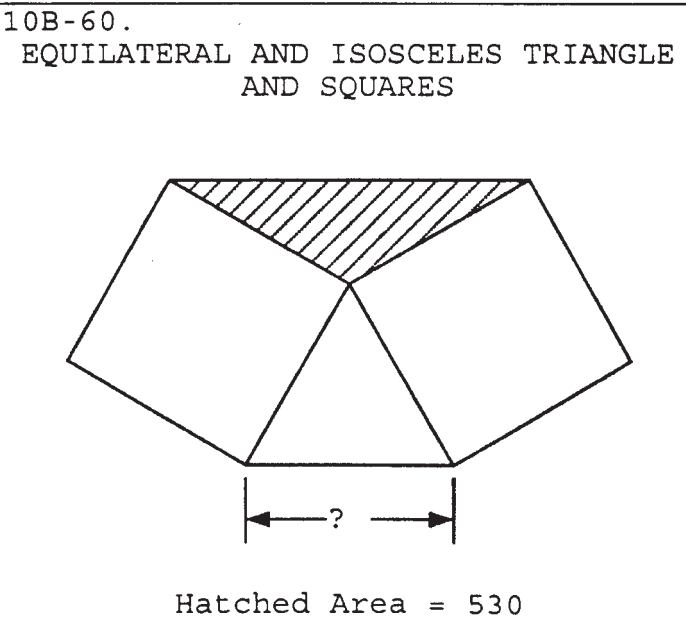
10B-56. (rad) What is $\int_0^{\pi/4} \frac{\sin(5x - \pi)dx}{\cos^2(5x - \pi)}$? ----- 56= _____

10B-57. What is the ratio of side lengths of a rectangle inscribed inside a semicircle if the rectangle area is maximized? The ratio is a number greater than 1. ----- 57= _____

10B-58. If $\mathbf{C} = \begin{bmatrix} 34 & 17 \\ 17 & -20 \end{bmatrix}$ and $\mathbf{D} = \begin{bmatrix} 9f & 24 \\ 24 & 2f \end{bmatrix}$, and the determinant of \mathbf{CD} equals 25, what is f if f is positive? ----- 58= _____



10B-59 = _____



10B-60 = _____

10B-61.
$$\frac{\sqrt{(1.56)^3} \times \{e^{(\pi)(0.946)}\}^3}{\sqrt[3]{e^{(-0.741)} \times e^{(0.521)}}}$$
 ----- 61= _____

10B-62. (rad) $\cos(1.64 - 0.51) - \cos(1.64 + 0.51)$ ----- 62= _____

10B-63. (deg) $\sin(-20.5^\circ)\cos(126^\circ) + \cos(-20.5^\circ)\sin(126^\circ)$ ----- 63= _____

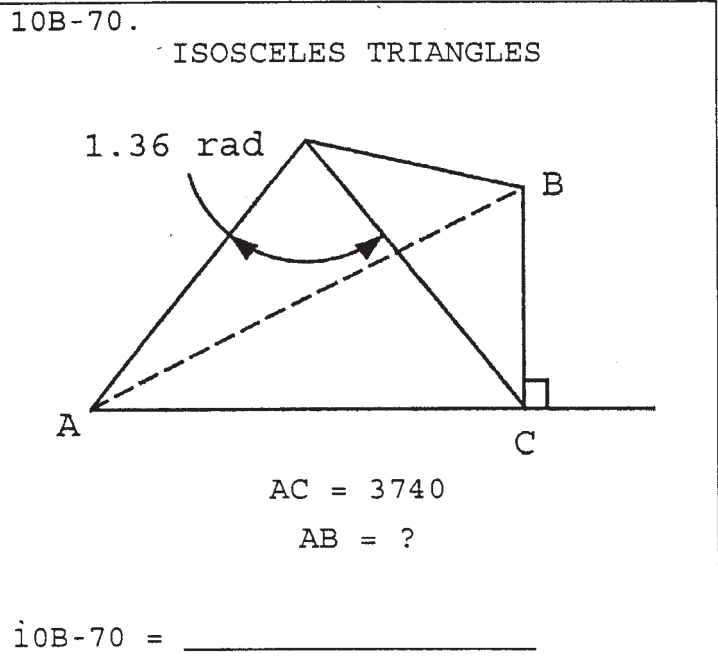
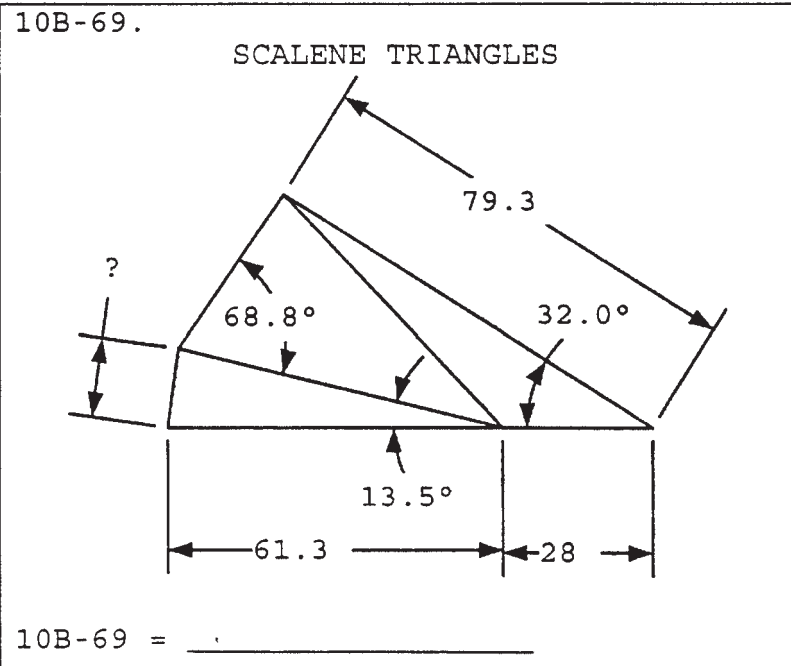
10B-64. $1 + (0.629) + \frac{(0.629)^2}{2} + \frac{(0.629)^3}{6} + \frac{(0.629)^4}{24}$ ----- 64= _____

10B-65. (rad) $\frac{(-72.8)(55.2) - \ln\{(0.361) + (-2.34)e^{(-3.53)}\}}{\arcsin\{(4.82)/(7.99 + 30.7)\}}$ ----- 65= _____

10B-66. Lenny starts with a full, 3-cup container of 22% salt solution. He divides the solution in half. To one half, he adds water to double the volume and refills the original container, discarding the left-over mixture. How many times must this procedure be done to dilute the original 22% solution down to just less than 3%? ----- 66= _____ integer

10B-67. Two cars sit at a traffic light with the first one 5 feet ahead. When the light turns green, the first starts accelerating at 17 ft/s², and, after a delay of 3 seconds, the second car has the same acceleration. How far apart are they when the first car reaches 45 mph? ----- 67= _____ ft

10B-68. A 70-in piece of string is used to form a triangle with sides in the ratio 3:8:9. What is the triangle area? --- 68= _____ in²



10B-31 = 721	10B-41 = -28600	10B-51 = 7.19	10B-61 = 15600
= 7.21x10 ²	= -2.86x10 ⁴	= 7.19x10 ⁰	= 1.56x10 ⁴
10B-32 = 0.000338	10B-42 = 664000	10B-52 = -2880	10B-62 = 0.974
= 3.38x10 ⁻⁴	= 6.64x10 ⁵	= -2.88x10 ³	= 9.74x10 ⁻¹
10B-33 = -0.0212	10B-43 = 7.05	10B-53 = 0.278	10B-63 = 0.964
= -2.12x10 ⁻²	= 7.05x10 ⁰	= 2.78x10 ⁻¹	= 9.64x10 ⁻¹
10B-34 = 0.224	10B-44 = 27.1	10B-54 = 0.584	10B-64 = 1.87
= 2.24x10 ⁻¹	= 2.71x10 ¹	= 5.84x10 ⁻¹	= 1.87x10 ⁰
10B-35 = 2.04x10 ⁻⁶	10B-45 = 3.62x10 ⁸	10B-55 = 0.00997	10B-65 = -32200
		= 9.97x10 ⁻³	= -3.22x10 ⁴
10B-36 =	10B-46 = 44.0	10B-56 = 0.483	10B-66 = 7 integer
1.58x10 ² , 160, 146	= 4.40x10 ¹	= 4.83x10 ⁻¹	
10B-37 = 14.6	10B-47 = 1.91	10B-57 = 2.00	10B-67 = 127
= 1.46x10 ¹	= 1.91x10 ⁰	= 2.00x10 ⁰	= 1.27x10 ²
10B-38 = 30.2	10B-48 = 0.681	10B-58 = 5.66	10B-68 = 145
= 3.02x10 ¹	= 6.81x10 ⁻¹	= 5.66x10 ⁰	= 1.45x10 ²
10B-39 = 29.6	10B-49 = 277	10B-59 = 7.04	10B-69 = 14.3
= 2.96x10 ¹	= 2.77x10 ²	= 7.04x10 ⁰	= 1.43x10 ¹
10B-40 = 129	10B-50 = 2.84	10B-60 = 35.0	10B-70 = 4200
= 1.29x10 ²	= 2.84x10 ⁰	= 3.50x10 ¹	= 4.20x10 ³

**University Interscholastic League
MATHEMATICS CONTEST
HS • Invitation B • 2010
Answer Key**

- | | | |
|-------|-------|-------|
| 1. A | 21. D | 41. C |
| 2. C | 22. A | 42. C |
| 3. E | 23. E | 43. D |
| 4. B | 24. D | 44. D |
| 5. B | 25. B | 45. A |
| 6. C | 26. B | 46. A |
| 7. C | 27. C | 47. A |
| 8. B | 28. D | 48. A |
| 9. A | 29. E | 49. D |
| 10. B | 30. C | 50. C |
| 11. B | 31. B | 51. E |
| 12. D | 32. B | 52. C |
| 13. A | 33. D | 53. B |
| 14. E | 34. D | 54. D |
| 15. C | 35. D | 55. C |
| 16. A | 36. A | 56. B |
| 17. E | 37. C | 57. A |
| 18. B | 38. D | 58. D |
| 19. E | 39. B | 59. E |
| 20. B | 40. B | 60. C |