



Indiana Academic Super Bowl

Math Round

2019 – Coaches Practice

A Program of the Indiana Association of School Principals



Students:

Throughout this round we will be pronouncing mathematic symbols and concepts as spoken words. If there are any discrepancies between what is said and what you see on the screen, the screen supersedes what is spoken.

The only calculators allowed during this competition are the following models:

TI-30Xa and TI-30X IIS

Any figure shown may not be drawn to scale.

SD-CP-M-1

The binary number 10101010 is equal to which decimal number?

- A. 170
- B. 172
- C. 174
- D. 176

SD-CP-M-2

If the binary number $11abcd$ is equal to the decimal number 59, which of the digits a , b , c , or d would be 0?

- A. a
- B. b
- C. c
- D. d

SD-CP-M-3

What binary number equals the decimal number 45?

- A. 100101
- B. 101011
- C. 101101
- D. 101111

SD-CP-M-4

If the decimal number 2000 is written as a binary number, what is the SUM of the digits of this binary number?

- A. 4
- B. 5
- C. 6
- D. 7

SD-CP-M-5

If the binary number 110101 and 101111 are ADDED, what is the sum?

- A. 1100010
- B. 1100110
- C. 1101100
- D. 1100100

SD-CP-M-6

The addition of two binary numbers is shown.
What is the SUM of the digits a , b , c , and d ?

$$\begin{array}{r} 10111 \\ + 10c1a \\ \hline 10d0b0 \end{array}$$

- A. 1
- B. 2
- C. 3
- D. 4

SD-CP-M-7

Which decimal number equals the sexagesimal number 2, 37?

- A. 127
- B. 137
- C. 147
- D. 157

SD-CP-M-8

If the sexagesimal number 20, d , 17 equals the decimal number 72677, what is d ?

- A. 10
- B. 11
- C. 12
- D. 13

SD-CP-M-9

If the sexagesimal number 2, d , 5, 11 is equal to the decimal number 507911, what is true of d ?

- A. d is divisible by 2
- B. d is divisible by 5
- C. d is divisible by 7
- D. d is divisible by 11

SD-CP-M-10

The decimal number 46279 is equal to the sexagesimal number a, b, c . What is the SUM of the digits a, b , and c ?

- A. 79
- B. 80
- C. 81
- D. 82

SD-CP-M-11

The decimal number 230450 is equal to the sexagesimal number a, b, c, d . Which of the digits a, b, c , or d is 0?

- A. a
- B. b
- C. c
- D. d

SD-CP-M-12

If the sexagesimal number $4a, 3b$ equals 2907, and the sexagesimal number $2a, b$ equals 1449, what is $a + b$?

- A. 19
- B. 20
- C. 21
- D. 22

SD-CP-M-13

What is the SUM of the sexagesimal numbers 4, 23, 53 and 15, 36, 58?

- A. 20, 0, 51
- B. 20, 1, 51
- C. 19, 59, 51
- D. 19, 0, 51

SD-CP-M-14

The largest four digit sexagesimal number would be equal to which decimal number?

- A. 12338299
- B. 12959999
- C. 13011299
- D. 13784599

SD-CP-M-15

If the sexagesimal number 24, 43, 39 is SUBTRACTED from the sexagesimal number 31, 42, 19 the result would be which of the following?

- A. 6, 59, 30
- B. 6, 59, 40
- C. 6, 58, 30
- D. 6, 58, 40

SD-CP-M-16

The twelve digit binary number 111111111111 is equal to which sexagesimal number?

- A. 1, 28, 15
- B. 1, 8, 15
- C. 1, 18, 13
- D. 1, 18, 17

SD-CP-M-17

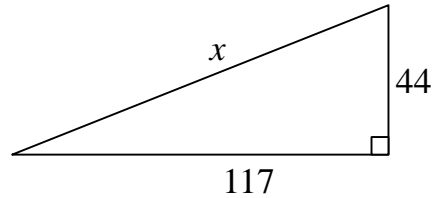
The binary number 111100111 is equal to which sexagesimal number?

- A. 8, 7
- B. 7, 8
- C. 7, 6
- D. 6, 7

SD-CP-M-18

Find x

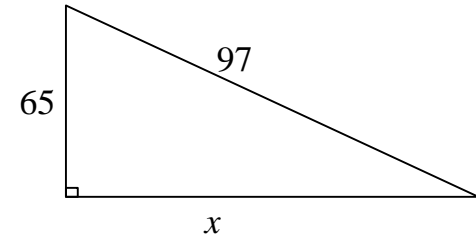
- A. 124.6
- B. 124.8
- C. 125.0
- D. 125.2



SD-CP-M-19

Find x

- A. 72
- B. 73
- C. 74
- D. 75



SD-CP-M-20

Given the four numbers 36, 42, 77, and 85, three of them are the sides of a right triangle. Which number cannot be one of the three sides?

- A. 36
- B. 42
- C. 77
- D. 85

SD-CP-M-21

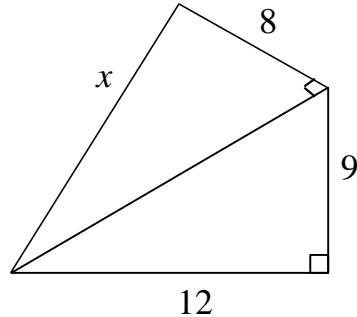
The hypotenuse of a right triangle is $9\sqrt{2}$ and one leg is $6\sqrt{3}$. How long is the other leg?

- A. $4\sqrt{5}$
- B. $4\sqrt{6}$
- C. $3\sqrt{5}$
- D. $3\sqrt{6}$

SD-CP-M-22

In the figure, what is x ?

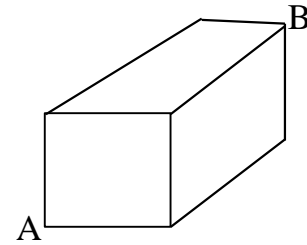
- A. 28
- B. 21
- C. 19
- D. 17



SD-CP-M-23

In the cube shown, each edge is 6. How long is diagonal \overline{AB} ?

- A. 10.4
- B. 10.6
- C. 10.8
- D. 11.0



SD-CP-M-24

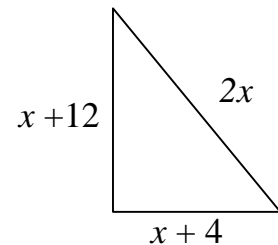
A 12 ft. long ladder is leaned against a building so that the foot of the ladder is 4 ft. from the base of the building. How high on the building does the top of the ladder reach?

- A. 10.9 ft.
- B. 11.1 ft.
- C. 11.3 ft.
- D. 11.5 ft.

SD-CP-M-25

Which equation could be used to solve for x ?

- A. $x^2 - 16x - 80 = 0$
- B. $x^2 + 16x - 80 = 0$
- C. $x^2 - 14x - 60 = 0$
- D. $x^2 + 14x + 80 = 0$



SD-CP-M-26

Find the volume of a cylinder with radius 7.5 and height 10.2

- A. 1790.7
- B. 1794.9
- C. 1798.3
- D. 1802.5

SD-CP-M-27

The circumference of the base of a cylinder is $3\pi\sqrt{2}$. The height is 6. What is the volume of this cylinder?

- A. 27π
- B. 24π
- C. 30π
- D. 32π

SD-CP-M-28

What is the volume, V , and the lateral area, LA , of a cylinder with radius 2 and height 4?

- A. $V = 16\pi$, $LA = 16\pi$
- B. $V = 16\pi$, $LA = 12\pi$
- C. $V = 12\pi$, $LA = 16\pi$
- D. $V = 12\pi$, $LA = 12\pi$

SD-CP-M-29

A coin is shaped like a cylinder that has a diameter of 4.4 centimeters and a height of 0.4 centimeters. The coin is a mixture of 90% pure gold and 10% other metals. If pure gold weighs 19.32 grams per cubic centimeter, what is the weight of the gold in this coin?

- A. 82.4 grams
- B. 94.1 grams
- C. 105.8 grams
- D. 117.5 grams

SD-CP-M-30

Find the volume, V , and lateral area, LA , of a cone if the radius of the base is 3 and the height is 4.

- A. $V = 15\pi$, $LA = 15\pi$
- B. $V = 15\pi$, $LA = 12\pi$
- C. $V = 12\pi$, $LA = 12\pi$
- D. $V = 12\pi$, $LA = 15\pi$

SD-CP-M-31

The volume of a cone is 262 and the radius of the base is 5. What is the slant height of this cone?

- A. 10.8
- B. 11.0
- C. 11.2
- D. 11.4

SD-CP-M-32

The lateral area of a cone is 136π and the radius of its base is 8. Which is TRUE of the height of this cone?

- A. The height is divisible by 2
- B. The height is divisible by 5
- C. The height is divisible by 7
- D. The height is divisible by 11

SD-CP-M-33

The base of a prism is a regular hexagon with each edge equal to 3. Its height is 9. What are the lateral area, LA , and volume, V , of this prism?

- A. $LA = 162$ and $V = 210.4$
- B. $LA = 182$ and $V = 200.4$
- C. $LA = 142$ and $V = 190.4$
- D. $LA = 202$ and $V = 180.4$

SD-CP-M-34

A square prism with base edge s and height, h , has a volume, V , and lateral area, LA , that are numerically equal (but not the same units). Which of the following is true?

- A. V and LA are equal whenever $s = h$
- B. V and LA are not equal for any choice of s and h
- C. V and LA are equal when $h = 8$ and s is any positive number
- D. V and LA are equal when $h = 4$ and s is any positive number

SD-CP-M-35

A cube has a volume of 2744. Which is TRUE of the area of each face of this cube?

- A. it is divisible by 6
- B. it is divisible by 7
- C. it is divisible by 8
- D. it is divisible by 9

SD-CP-M-36

A prism with a regular hexagon for a base is inscribed inside a cylinder with radius 6 and height 12. What is the difference in the volumes of the cylinder and the prism?

- A. 234.8
- B. 239.8
- C. 244.8
- D. 249.8

SD-CP-M-37

A prism has an equilateral triangle for a base. If the perimeter of the base is 24 and the height of the prism is 20, what is the volume of this prism?

- A. $312\sqrt{3}$
- B. $316\sqrt{3}$
- C. $320\sqrt{3}$
- D. $324\sqrt{3}$

SD-CP-M-38

A pyramid has a regular hexagon with edges 10 for its base. The lateral edges of this pyramid are 16. What are the slant height, l , and the height, h , of this pyramid?

- A. $l = 13.9$ and $h = 10.2$
- B. $l = 14.1$ and $h = 10.9$
- C. $l = 15.2$ and $h = 12.5$
- D. $l = 16.8$ and $h = 12.8$

SD-CP-M-39

Find the volume of a cone if the diameter of the base and the height of the cone are both 18.

- A. 1526.8
- B. 1520.6
- C. 1530.4
- D. 1536.2

SD-CP-M-40

A pyramid has a base that is a regular hexagon. The base edge is 7 and the slant height is 13. What is the lateral area of this pyramid?

- A. 273
- B. 275
- C. 277
- D. 279

CP-M-41

A square pyramid has a base edge of 15 and a height of 19. What is its volume?

- A. 1420
- B. 1425
- C. 1430
- D. 1435

CP-M-42

A square pyramid has a base with area 196 and a slant height of 25. What is the volume of this pyramid?

- A. 1568
- B. 1572
- C. 1576
- D. 1580

CP-M-43

A square pyramid has a height of 8 and a slant height of 15. What is the volume of the pyramid?

- A. $1708\frac{2}{3}$
- B. $1711\frac{1}{3}$
- C. $1714\frac{2}{3}$
- D. $1717\frac{1}{3}$

CP-M-44

A square pyramid has a base with area 36 and a slant height of 9. What is the lateral area of this pyramid?

- A. 108
- B. 112
- C. 116
- D. 120

CP-M-45

In a square pyramid each base edge is 14 and the height is 24. What is the lateral area of this pyramid?

- A. 660
- B. 680
- C. 700
- D. 720

CP-M-46

In a square pyramid, each lateral edge is 15 and the slant height is 12. What is the lateral area of this pyramid?

- A. 432
- B. 436
- C. 440
- D. 444

CP-M-47

A pyramid has an equilateral triangle with perimeter 24 as its base. If its height is 27, what is the volume?

- A. $128\sqrt{3}$
- B. $136\sqrt{3}$
- C. $144\sqrt{3}$
- D. $156\sqrt{3}$

CP-M-48

A pyramid has a regular hexagon with base edges of 4 and lateral edges of 9. What is the volume of this pyramid?

- A. 95.3
- B. 98.5
- C. 111.7
- D. 114.9

CP-M-49

What is the volume of the frustum of a square pyramid with height 3, and base edges of 7 and 5?

- A. 107
- B. 108
- C. 109
- D. 110

SD-CP-M-50

Which statement is true of the ancient Egyptian and Babylonian number systems?

- A. They both used a positional number system
- B. The Egyptians used a positional system, but the Babylonians did not
- C. The Babylonians used a positional system, but the Egyptians did not
- D. Neither culture used a positional system

SD-CP-M-51

Let EH = the Egyptian hieratic numeral system and BY = the Babylonian sexagesimal system. Also consider the media: stone building, stone tablet, clay tablet, and papyrus. Which matches each number system with the media it has usually been found on?

- A. EH = stone building; BY = stone tablet
- B. EH = stone building; BY = clay tablet
- C. EH = papyrus; BY = stone tablet
- D. EH = papyrus; BY = clay tablet

SD-CP-M-52

Which of the following was not a disadvantage of the Egyptian hieroglyphic number system?

- A. numbers written in this system could not be carried around from place to place
- B. multiplication of numbers was difficult
- C. addition of numbers was difficult
- D. even relatively small numbers took a large number of symbols to express

SD-CP-M-53

In the Rhind papyrus, the scribe Ahmes describes the method the ancient Egyptians used to multiply two whole numbers a and b . Which of these is the method he described?

- A. a table of squares and the formula $ab = [(a+b)^2 - (a-b)^2]/4$
- B. a primitive form of logarithms and the fact that $\log ab = \log a + \log b$
- C. successively added one number to itself to get the sequence $a, 2a, 3a, 4a, \dots$
- D. successively doubling to get the sequence $a, 2a, 4a, 8a, \dots$

SD-CP-M-54

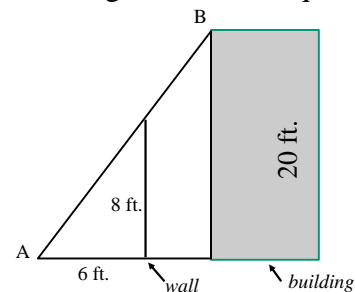
If the Babylonian number 𒌦 , 𒌶 , 𒌷 is written as a base 10 number, what would it be?

- A. 7863
- B. 78063
- C. 140463
- D. 432663

SD-CP-M-55

A ramp is to be placed 6 feet from the base of an 8 foot wall, so that it reaches beyond the wall to a point on a building 20 feet above the ground. What is the approximate length of board required for the ramp?

- A. 24 ft.
- B. 25 ft.
- C. 29 ft.
- D. 33 ft.



SD-CP-M-56

An isosceles triangle has sides of lengths 20 inches, 20 inches, and 26 inches. What is the measure of the largest angle?

- A. 87°
- B. 81°
- C. 76°
- D. 74°

SD-CP-M-57

If $\tan \theta = 2$ and θ is a first quadrant angle, then $\sec \theta =$

- A. $\sqrt{5}$
- B. $\frac{\sqrt{5}}{2}$
- C. $\frac{\sqrt{5}}{5}$
- D. $\frac{2\sqrt{5}}{5}$

SD-CP-M-58

A triangular lot has the dimensions 15.5 meters, 22.8 meters, and 31.6 meters. What is the smallest corner angle in the lot?

- A. 24.3°
- B. 27.5°
- C. 36.6°
- D. 42.8°

SD-CP-M-59

A uniform grade of 1.4% on a highway means that the vertical change in the road is 1.4 feet for each 100 feet of horizontal run. The distance between two points on such a road is 426.7 feet. Find the difference in elevation between these two points.

- A. 4.79 ft.
- B. 4.98 ft.
- C. 5.48 ft.
- D. 5.97 ft.

SD-CP-M-60

An airplane pilot wants to clear a 110 foot hill by at least 50 feet. If that pilot starts at a point 1200 feet from the foot of the hill, what can be the least angle of climb?

- A. 6°
- B. 7°
- C. 8°
- D. 9°

SD-CP-M-61

If $\cos \theta = \frac{-4\sqrt{5}}{9}$, then $\csc \theta =$

(θ is a 2nd quadrant angle).

- A. 9
- B. $\frac{\sqrt{5}}{20}$
- C. $\frac{-9\sqrt{5}}{20}$
- D. $\frac{9}{20}$

SD-CP-M-62

If $\cos \theta = \frac{15}{17}$ and θ is a 4th quadrant angle,

then $\tan \theta =$

- A. $-\frac{8}{17}$ B. $-\frac{17}{8}$
- C. $-\frac{15}{8}$ D. $-\frac{8}{15}$

SD-CP-M-63

If $\sin \theta = \frac{3}{5}$, then $\sec \theta =$
(θ is a 1st quadrant angle)

- A. $\frac{5}{3}$ B. $-\frac{5}{3}$
- C. $\frac{5}{4}$ D. $\frac{5}{2}$

SD-CP-M-64

Simplify: $(\tan \theta + 1)(\tan \theta - 1)$.

- A. $\tan^2 \theta + 1$
- B. $\sec^2 \theta - 1$
- C. $\tan^2 \theta$
- D. $\sec^2 \theta - 2$

SD-CP-M-65

Simplify: $\frac{\cot \theta}{\cos \theta}$

- A. $\csc \theta$
- B. $\sin \theta$
- C. $\sec \theta$
- D. $\tan \theta$

SD-CP-M-70

Which of the following polynomials can be factored by grouping?

- A. $8x^3 - 64$
- B. $x^3 - 4x^2 + 4x - 16$
- C. $x^2 + 4x + 4$
- D. $x^3 - 3x^2 - 3x - 9$

SD-CP-M-71

How many possible rational zeros are there for the function $f(x) = 6x^3 + 7x^2 + 3x - 4$?

- A. 12
- B. 16
- C. 18
- D. 24

SD-CP-M-72

How many real number solutions does the equation $4x^4 + 20x^2 = -25$ have?

- A. 0
- B. 1
- C. 2
- D. 4

SD-CP-M-73

Divide $x^3 - 9x + 5$ by $x - 3$

- A. $x^2 + 3x + 5$
- B. $x^2 + 3x - \frac{5}{x - 3}$
- C. $x^2 + 3x - 18 + \frac{59}{x - 3}$
- D. $x^2 + 3x + \frac{5}{x - 3}$

SD-CP-M-74

What is the zero of the first-degree binomial term of the factorization of $x^3 + 64$?

- A. -8
- B. -4
- C. 4
- D. 8

SD-CP-M-75

What is the average of the possible rational zeros of the function

$$f(x) = 6x^4 - 3x^3 + x + 10?$$

- A. 0
- B. 2
- C. 8
- D. 30

SD-CP-M-76

For a polynomial function, when a factor $x - k$ is raised to an even power, what is true of the function's graph at $x = k$?

- A. the graph crosses the x -axis
- B. the function is undefined
- C. the graph is tangent to the x -axis
- D. the graph is parallel to the x -axis

SD-CP-M-77

Which of the following is true of the equation $x^5 = 256x$?

- A. its constant coefficient is 256
- B. it has three positive solutions
- C. it has two imaginary solutions
- D. it can have fewer than five zeros

SD-CP-M-78

Which of the following polynomials is written in standard form?

- A. $f(x) = 2$
- B. $f(x) = 16 - x^2$
- C. $f(x) = 3x^3 + x^4$
- D. $f(x) = x + \frac{1}{3}x^3$

SD-CP-M-79

Synthetic division is also called which of the following?

- A. replacement
- B. synthetic distribution
- C. synthetic substitution
- D. coefficient alignment

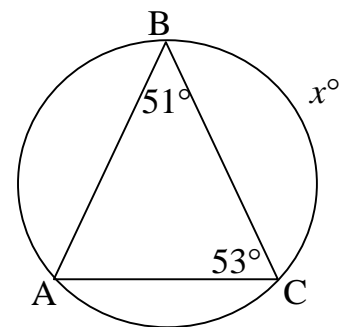
SD-CP-M-80

Solve $2x^5 + 24x = 14x^3$

- A. $x = \pm\sqrt{3}, 2$
- B. $x = 0, \sqrt{3}, \pm 2$
- C. $x = \pm\sqrt{3}, \pm 2$
- D. $x = 0, \pm\sqrt{3}, \pm 2$

SD-CP-M-81

Using the diagram, find the value of x .

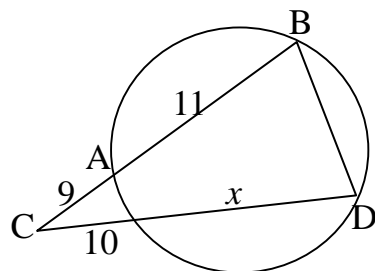


- A. 76
- B. 106
- C. 114
- D. 152

SD-CP-M-82

Find the value of x .

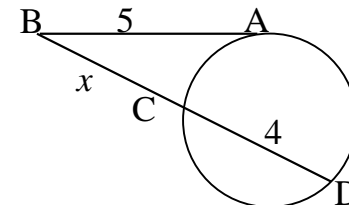
- A. 8
- B. 9.9
- C. 12.2
- D. 30



SD-CP-M-83

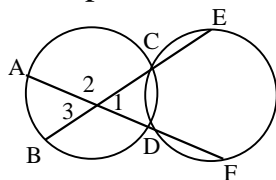
Using the diagram, find the value of x .

- A. 3
- B. $-2 + \sqrt{29}$
- C. 6
- D. $\frac{25}{4}$



SD-CP-M-84

Which relationship is NOT true in the given figure?

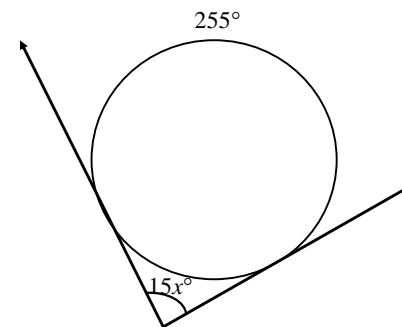


- A. $m\angle 1 = \frac{1}{2}(m\widehat{CD} + m\widehat{AB})$
- B. $m\angle 1 = \frac{1}{2}(m\widehat{EF}) - m(\widehat{CD})$
- C. $m\angle 2 = \frac{1}{2}(m\widehat{BD} - m\widehat{AC})$
- D. $m\angle 3 = \frac{1}{2}(m\widehat{EF} - m\widehat{CD})$

SD-CP-M-85

Find the value of x .

- A. 5
- B. 7
- C. 10
- D. 75



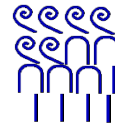
SD-CP-M-86

What is the standard form of the equation of a circle with center $(-3, 1)$ and radius 2?

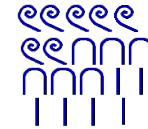
- A. $(x - 3)^2 + (y - 1)^2 = 2$
- B. $(x - 3)^2 + (y - 1)^2 = 4$
- C. $(x + 3)^2 + (y - 1)^2 = 2$
- D. $(x + 3)^2 + (y - 1)^2 = 4$

SD-CP-M-87

What is the sum of the Egyptian hieroglyphic numbers



and



?

A.



B.



C.



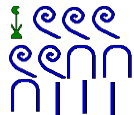
D.



SD-CP-M-88

In the Egyptian hieroglyphic system, the base 10 number 2433 would have been written as _____.

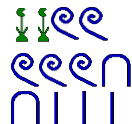
A.



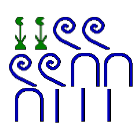
B.



C.



D.



SD-CP-M-89

If the number is subtracted from the number , the result is _____.

A.



B.




C.



D.






SD-CP-M-94

If the Babylonian number  is tripled, what would the result be?

- A.  , 
- B.  , 
- C.  , 
- D.  , 

SD-CP-M-95









The Babylonian number  ,  , 

would equal which base 10 number?

- A. 121,102
B. 121,202
C. 121,212
D. 121,222

SD-CP-M-96

If the binary number 1111100 were written as an ancient Babylonian number, the results would be which of the following?

- A.  , 
- B.  , 
- C.  , 
- D.  , 

SD Math Coaches Practice Answer Key:

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

SD Math Coaches Practice Answer Key:

61. A	71. B	81. D	91. B
62. D	72. A	82. A	92. B
63. C	73. D	83. B	93. A
64. D	74. B	84. C	94. A
65. A	75. A	85. A	95. B
66. C	76. C	86. D	96. D
67. B	77. C	87. C	
68. A	78. A	88. D	
69. B	79. C	89. B	
70. B	80. D	90. D	

PURDUE
UNIVERSITY

End of Math Round

Senior Academic Super Bowl
Area Contest – April 16, 2019

