

Eighth Grade - Excellence in Mathematics Contest - 2018

1. If $\frac{18}{42} = \frac{72}{X} = \frac{Y}{28}$, what does $X + Y$ equal?
- A. 180 B. 184 C. 188 D. 192 E. 196
2. A pair of jeans selling for \$36.80 was put on sale for 25% off. Then a 10% sales tax was applied to the sale price. When she bought this pair of jeans, how much change from a \$50 bill did the customer receive?
- A. \$9.52 B. \$18.08 C. \$19.64 D. \$22.40 E. \$39.88
3. In his gold medal snowboarding halfpipe run in the 2018 Winter Olympics, Shaun White performed five tricks. On these five tricks, his degrees of rotation were 1440° , 1440° , 540° , 1260° , and 1260° . What is the total number of rotations that he made?
- A. 16 B. $16\frac{1}{2}$ C. 17 D. $17\frac{1}{2}$ E. 18
4. Among all the positive factors of 144, one is randomly selected. What is the probability that it is a multiple of 3?
- A. $\frac{2}{5}$ B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. $\frac{3}{5}$ E. $\frac{8}{15}$
5. In the following sequence, how many sets of consecutive numbers sum to 12? For example, $6+1+5$
Note: It is possible that some of these sets overlap.

2, 5, 1, 4, 2, 3, 7, 6, 1, 5, 2, 4, 8, 4, 1, 5

- A. Fewer than 6 B. 6 C. 7 D. 8 E. More than 8
6. P, Q, and R represent numbers located on the number line as shown.



How many of the following five expressions represent a negative number?

$$\mathbf{R - P ; \quad Q - P ; \quad P + Q + R ; \quad R \cdot Q + P ; \quad \frac{Q}{P} \cdot R}$$

- A. 1 B. 2 C. 3 D. 4 E. 5
7. How many 3-digit multiples of 6 can be formed by selecting three distinct digits from the set **{4, 5, 6, 7, 8}**?
- A. 10 B. 12 C. 14 D. 16 E. 18

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8. The average weight of the five offensive linemen of the New England Patriots was reported as 321 pounds. When that seemed too high, a coach realized that the weight of center David Andrews had been written down incorrectly. When Andrews' weight was corrected to 295 pounds, the average weight was correctly computed as 311 pounds.

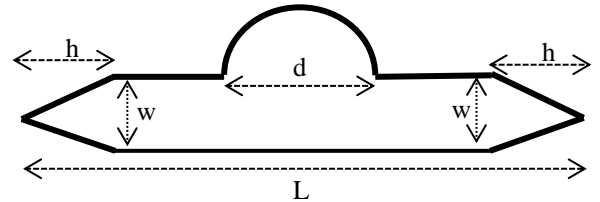
What incorrect weight in pounds had been written for David Andrews?

- A. 325 B. 330 C. 335 D. 340 E. 345

9. A *FoxTrot* cartoon reports this profile from Nevada of a UFO flying saucer. Its measurements in meters are:

$$h = 4 \text{ m}; \quad w = 3 \text{ m}; \quad d = \sqrt{72/\pi} \text{ m}; \quad L = 18 \text{ m}$$

In square meters, what is the area of this profile image?



- A. 45 B. 51 C. 60 D. 75 E. 78

10. Compute the area in square units of the triangle bounded by the three lines:

$$x = -4, \quad x - 2y = 2, \quad \text{and} \quad x + y = 8.$$

- A. 75 B. 80 C. 85 D. 90 E. 100

11. Determine the sum of the two numbers which are twice as far from 32 as from 20.

- A. 20 B. 24 C. 32 D. 36 E. 68

12. In 2018, Chris Mazdzer finished second to become the first American male to win an Olympic medal in luge. His total time in four races was only 0.026 seconds behind Austrian David Gleirscher.

At a speed of 80 miles per hour, how many inches would Mazdzer travel in 0.026 seconds?

Round to the nearest inch. There are 5280 feet in 1 mile.

- A. 20 B. 37 C. 44 D. 56 E. 64

13. When two digits of a 3-digit number are exchanged [for example, 971 and 791], the positive difference between the two 3-digit numbers could be:

- A. 37 B. 83 C. 101 D. 393 E. 594

14. $\frac{4^3 * 64^2}{8^6 * 16^3} = 2^N$ What does N equal?

- A. -12 B. -6 C. 8 D. 16 E. 20

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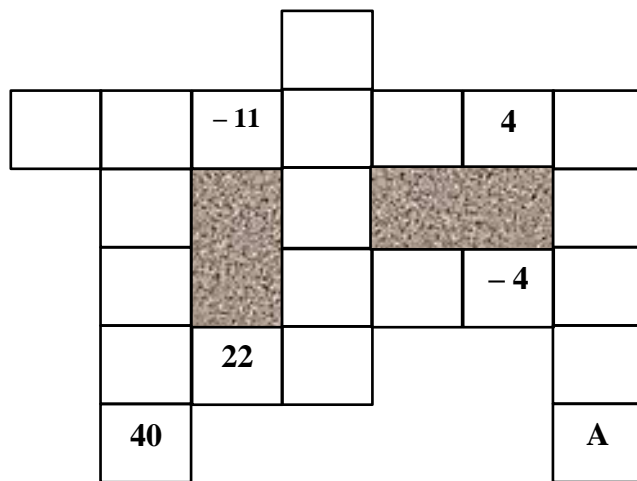
15. When Nance does not use his cell phone, a full charge lasts 36 hours. While using the phone, a full charge would last 4 hours. Nance's phone is fully charged at 6 AM. From 6 AM to 10 AM, Nance used his phone for 2.5 hours. Then his father took it away and set the phone aside. At what time will Nance's phone become fully discharged?

- A. 7:30 PM B. 8:00 PM C. 9:30 PM D. 10:00 PM E. 11:30 PM

16. On rectangle ABCD, points P and Q are on AB such that $AP = PQ = QB$. M is the midpoint of BC. What is the ratio of the area of triangle DPM to the area of triangle MPQ?

- A. $5/2$ B. 3 C. 4 D. 5 E. 6

17. The numbers in each row and in each column of white (unshaded) squares form an increasing arithmetic sequence or a decreasing arithmetic sequence.



What number is in the cell marked "A"?

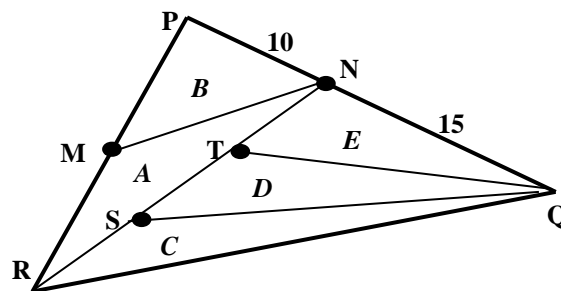
- A. 49 B. 13 C. -33
D. -39 E. -31

18. Let $A = (-2, 7)$ and $B = (6, 3)$.

What is the x-intercept of the perpendicular bisector of segment AB?

- A. $-1/2$ B. $1/2$ C. 1 D. $3/2$ E. 2

19. On $\triangle PRQ$, N is on PQ such that $PN = 10$ cm and $NQ = 15$ cm. M is the bisector of PR. Points S and T trisect RN.



Which of the five triangles, A through E, has the largest area?

- A. B only B. E only C. A and B only
D. C, D, and E only E. All five have the same area

20. For how many ordered pairs (x, y) of positive integers does $5x + 7y = 2018$?

- A. 40 B. 41 C. 56 D. 57 E. 58

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21. Use the clues below to place these seven numbers in the proper sequence: **2, 3, 7, 8, 9, 10, 13**

- The odd numbers and even numbers alternate
- 10 and 7 are adjacent [in either order]
- 3 is left of both the 10 and the 7 but is not adjacent to either one
- The sum of the 5th and 7th numbers is 16
- No two consecutive numbers are adjacent to each other

_____ ; _____ ; _____ ; _____ ; _____ ; _____ ; _____

The sum of the 1st and 7th numbers in the sequence is:

- A. 10 B. 12 C. 16 D. 20 E. 22

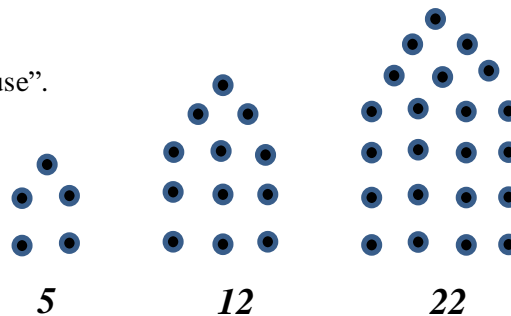
22. How many more diagonals does a regular octagon have than a regular hexagon?

Note: A *diagonal* is any segment that joins two vertices of a convex polygon but is not an edge of the polygon.

- A. 10 B. 11 C. 13 D. 20 E. 22

23. *House numbers* are associated with arrays of dots in the form of a “house”.

The first three *House Numbers*, as illustrated, are 5; 12; and 22.



With 5 as the 1st *House Number*, what is the 20th *House Number*?

- A. 590 B. 610 C. 631 D. 641 E. 651

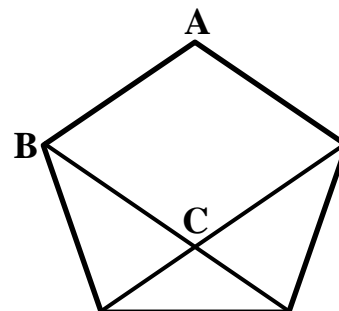
24. There are a total of N sparrows and pigeons on a telephone wire. When five sparrows fly away, there remain two pigeons for every sparrow. After the five sparrows have flown away, 25 pigeons fly away, leaving three sparrows for every pigeon. What is N?

- A. 42 B. 50 C. 54 D. 60 E. No solution

25. Starting at one of the three given points (A or B or C), your goal is trace each segment exactly once. You are allowed to visit the same point more than once.

At which point could you start?

- A. A only B. B only C. C only
 D. A or C only E. None of these



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26. In January 2018, the US GDP per capita [a measure of American wealth] was \$59,000. Warren Buffet predicted that it would rise by 1.2% per year for each of the next 15 years. According to his prediction, what will the GDP per capita be in January 2033? Round to the nearest hundred dollars.

- A. \$69,600 B. \$70,600 C. \$165,200 D. \$253,300 E. \$322,900

27. American Scott Tingle is currently orbiting the Earth on the International Space Station.

Assume that:

- the Space Station follows a path directly above the Earth's equator at an altitude of 250 miles
- it completes one orbit of Earth every 93 minutes
- the Earth is a sphere of diameter 7900 miles.

What distance in miles along the equator will Scott pass directly over while taking 12 minutes to eat lunch? Round to the nearest hundred miles.

- A. 3200 B. 3300 C. 5100 D. 6400 E. 6600

28. **A**, **BB**, **AAA**, and **CAB** are 1-digit, 2-digit, and 3-digit numbers. Each letter represents a certain digit and the digit "0" is not used.

If $A + BB + AAA = CAB$, what is the sum $A + B + C$?

- A. 14 B. 15 C. 16 D. 18 E. 20

29. Two factors of this cubic polynomial $2x^3 - hx + k$ are $x + 2$ and $x - 1$. Compute $h + k$.

- A. -4 B. -2 C. 4 D. 5 E. 10

30. Complete this 5 by 5 grid so that the numbers 1, 2, 3, 4, and 5 occur in each row and in each column. In addition, the seven greater than and less than symbols indicate which of the two adjacent numbers is larger or smaller.

What is the sequence of numbers in the BOTTOM row?

- A. 12354 B. 13254 C. 13452
D. 21453 E. 41253

			>	
^				<
				<
v		v	1	^

31. Aunt Mae's birthday was January 1. In the year that Aunt Mae died, her age (as an integer) was $1/37$ of the year of her birth. What is the oldest she could have been when she celebrated her birthday in 1950?

- A. 6 B. 26 C. 34 D. 42 E. 78

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32. Alpha, Beta, Gamma, Delta, and Epsilon have their birthdays on consecutive days but not in that order. Alpha's birthday is as many days before Gamma's as Beta's birthday is after Epsilon's. Delta's birthday is two days before Epsilon's. If Gamma's birthday is on a Wednesday, on what day is Epsilon's birthday?

- A. Monday B. Tuesday C. Thursday D. Friday E. Saturday

33. Tex agreed to work for one year for \$7100 and a horse. At the end of 7 months, he quit and received \$3475 and the horse. To the nearest dollar, how much was the horse worth?

- A. \$1510 B. \$1600 C. \$2115 D. \$2240 E. \$3625

34. Twelve points are equally spaced on a circle. How many sets of three points form an isosceles triangle? Note: An equilateral triangle does count as one isosceles triangle.

- A. 40 B. 48 C. 52 D. 56 E. 60

35. When a 2-digit number is added to a 3-digit number, there are two different ways for there to be exactly one carry.

5	¹	7		5	¹	7		
+		5	4	+		9	1	
5			9	6			2	8

N is a 2-digit number. If the addition $742 + N$ results in exactly one carry, how many values of N are possible?

- A. 36 B. 38 C. 40
D. 42 E. 44

36. In the Winter Olympics, the Biathlon combines cross-country skiing and shooting a rifle. If a competitor has an 80% probability of hitting each target, what is the probability that he will hit at least 18 of the 20 targets? Round to the nearest per cent.

- A. 14% B. 16% C. 18% D. 19% E. 21%

37. On a certain day during the year, Bekah noticed that:

- Two days earlier, she was 13 years old.
- Sometime during next year, she will be 16.

What date is Bekah's birthday?

- A. Jan. 1 B. Jan. 2 C. Dec. 30 D. Dec. 31 E. Cannot be determined

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38. The roots of the equation $x^2 + bx + c = 0$ are the squares of the roots of $x^2 + 2x + 3 = 0$.

Compute $b + c$.

- A. -9 B. -7 C. 7 D. 11 E. 13

39. Use these clues to place a digit 1 through 9 in each box.
In each row and column, digits may be repeated.

ACROSS:

1. Sum of digits is 13
3. The four digits form an increasing or decreasing arithmetic sequence
5. Each digit is even and their sum is 12
6. A perfect square

DOWN:

1. The sum of the digits is the same as the sum of the digits of 4 Down.
2. The sum of the first two digits is the same as the sum of the last two digits of 1 Down
3. A perfect cube.
4. An odd perfect cube.

	1	2	
	A		
3			4
5			
		6	

What number is in the square marked "A"?

- A. 4 B. 5 C. 7
D. 8 E. 9

40. ABCD is a tetrahedron with $AB = BC = AC = 2$ and $DA = DB = DC$. The base of a hemisphere is internally tangent to triangle ABC. Segments \overline{DA} , \overline{DB} , and \overline{DC} are each tangent to the hemisphere. Compute the length of \overline{DA} .

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