Multiple Choice: Indicate your answer in the box to the right of each question.

1. Evaluate $\frac{1}{2} + \frac{1}{3} - \frac{1}{4}$

    (a) $\frac{7}{12}$ (b) 1   (c) $\frac{5}{24}$ (d) $\frac{5}{12}$ (e) $\frac{2}{3}$

1. ___

2. If $x = 2$ and $y = -3$, find $(x - 6)(y + 4)$.

    (a) -24   (b) -4   (c) 4   (d) 8   (e) 24

2. ___

3. What is the day and time that occurs 100 hours after 2 p.m. on Monday?

    (a) Fri. 6 p.m.   (b) Sat. 6 a.m.   (c) Sat. 8 a.m.   (d) Sun. 4 a.m.   (e) Sun. 8 p.m.

3. ___

4. Alice received quiz grades of 85, 93, 97, and 94. What grade does she need to receive on the fifth quiz to have an exact 90 average?

    (a) 76   (b) 81   (c) 86   (d) 91   (e) 96

4. ___

5. The sequence 3, 6, 11, 22, 27, … is formed by starting with 3 and alternately doubling and adding 5 to the previous number. Which of the following numbers eventually occurs in this sequence?

    (a) 1016   (b) 1017   (c) 1018   (d) 1019   (e) None of these

5. ___

6. If $\frac{4}{3}x + \frac{2}{4}y = 7$, and $\frac{2}{3}x - \frac{1}{2}y = 5$, find x.

    (a) $\frac{5}{12}$ (b) 1   (c) $\frac{9}{4}$ (d) 4   (e) 6

6. ___

7. The 1st, 2nd, and 4th of four consecutive integers have a sum of 136. What is the 3rd of the four consecutive integers?

    (a) 43   (b) 44   (c) 45   (d) 46   (e) 47

7. ___

8. If $a = \sqrt{2} + \sqrt{27}$ and $b = \sqrt{3} + \sqrt{32}$, what is $a + b$ in simplest form?

    (a) $\sqrt{5} + \sqrt{59}$ (b) 8   (c) $5\sqrt{2} + 4\sqrt{3}$ (d) $\sqrt{2} + \sqrt{3} + \sqrt{27} + \sqrt{32}$ (e) $13\sqrt{6}$

8. ___

9. How many **integer** values of x are solutions of $(x^2 - 5)^2 = 16$?

    (a) 1   (b) 2   (c) 3   (d) 4   (e) More than 4

9. ___

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Short Answer: Write your answer and show your work in the space below each question.
Clearly indicate your final answer by drawing a box around it.

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10. Factor completely: $2x^2y^2 - 12x^2y + 16x^2$.

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11. Simplify: $6(x - 2) + 3x(x - 2) - 3x^2(x - 1)$.

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12. Solve for x: $\frac{3x^2}{x+2} = \frac{x^2-x}{x^2+x-2}$

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13. Of the 360 different arrangements of the letters in "CIRCLE", how many have the two C's next to each other?

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14. If $xy = 2016$, and x and y are positive integers, what is the smallest possible value of $x + y$?

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15. 24 identical equilateral triangles are arranged side-by-side without overlap, to create a regular hexagon. If each triangle has a perimeter of 504, what is the perimeter of the hexagon?

16. Ann has 3 times more Twitter followers than Bill. Bill has 7 less Twitter followers than Carl. Carl has half the number of Twitter followers that Denise has. Denise has 4 less Twitter followers than Ann. How many followers do each of them have?

17. A farmer stored her apple harvest in small sacks but decided to move all of the apples into larger sacks. If each large sack holds 20% more apples than a small sack and the switch resulted in 8 less sacks being used, how many large sacks were needed to hold the entire apple harvest?

18. Square ABCD has side length 2, and shares sides with, but does not overlap, equilateral triangles ABE and FAD. Find the length of segment EF.

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Long Answer: Write your solution in the space below each question. Make sure you include sufficient justification.

19. Define a **current** number to be a natural number that ends in 6 and whose digits are alternating 1 and 6. For example, 6, 16, 616, 1616, and 61616 are all current numbers.

a. Find a current number divisible by 9.
b. Find the smallest current number divisible by 9. You should explain why it's the smallest.
c. Can a current number be divisible by 19? Justify your answer.

20. Let f(n) denote how many n-digit positive integers with digits 1 and 2 do not contain adjacent 2's. For example, f(3) = 5 because there are 5 such integers: 111, 112, 121, 211, and 212.

a. What pattern is made by the values of f(1), f(2), f(3), f(4), f(5) … ?
b. Prove that the pattern holds forever.

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