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

1. Evaluate $\frac{3}{8} + \frac{1}{4}\left(\frac{8}{3} - \frac{2}{3}\right)$

   (a) 2   (b) $\frac{9}{8}$ (c) $\frac{7}{8}$ (d) 1   (e) $\frac{5}{8}$

   1. ☐

2. Evaluate $1 + 2\big(3 - 4(5 + x)\big)$ when $x = -6$

   (a) 15   (b) 3   (c) -1   (d) 81   (e) -81

   2. ☐

3. In the set of data {2, 3, 3, 5, 7, 10} which item would you remove to decrease the mean by 1?

   (a) 2   (b) 3   (c) 5   (d) 7   (e) 10

   3. ☐

4. Which day of the week comes 60 days after Tuesday?

   (a) Wednesday (b) Thursday   (c) Friday   (d) Saturday   (e) Sunday

   4. ☐

5. Troy writes down the number 1. Each minute, Troy writes down a number 1 more than twice the previously written number. Of all the numbers Troy writes, which is closest to 1000?

   (a) 977   (b) 997   (c) 1017   (d) 1023   (e) None of these

   5. ☐

6. If $3x + 7y = 10$ and $7x + 3y = 20$, what is the value of $4x$?

   (a) 21   (b) $\frac{42}{5}$ (c) 11   (d) $\frac{21}{10}$ (e) None of these

   6. ☐

7. The sum of four consecutive odd integers is 136. What is the smallest of the four numbers?

   (a) 25   (b) 27   (c) 29   (d) 31   (e) None of these

   7. ☐

8. If $(x + a)^2 = 49$ and $(x + b)^2 = 9$, which is a possible value of $a - b$?

   (a) 6   (b) $2\sqrt{10}$ (c) -10   (d) -40   (e) None of these

   8. ☐

9. Simplify $\sqrt{8} + \sqrt{18} + \sqrt{98}$

   (a) $12\sqrt{2}$ (b) $2\sqrt{31}$ (c) 17   (d) $\sqrt{124}$ (e) None of these

   9. ☐

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.

10. Simplify the expression $2x - 3(x - 2) + \left(x - 2(2x - 1)\right)$

11. Factor completely: $3x^4 - 10x^3 + 3x^2$

12. Simplify the expression: $\dfrac{x^2-5x+6}{x^3+4x^2} \cdot \dfrac{2x}{x-3} \cdot \dfrac{x^2+6x+8}{x^2-4}$

13. Patrick has shirts and ties in four colors: red, yellow, green and blue. How many shirt-tie combinations can he make if the shirt and the tie have to be in different colors?

14. If $x + y = 4$ and $x^2 + y^2 = 10$, compute the value of xy.

15. Joe is 4 years older than Ann. Ann is 2 years older than Bill. Next year, Bill will be half as old as Joe. How old is Ann right now?

16. What is the perimeter of a figure formed by attaching a square of side 17 to each side of a regular hexagon with sides of length 17?

17. A convoy of trucks carrying 2800 lbs. each started to cross a desert. When two trucks broke down and had to be abandoned their cargo was distributed equally between the other trucks, resulting in each working truck carrying 224 lbs. more. How many trucks were in the original convoy?

18. What is the area of an isosceles trapezoid with sides 5, 4, 5, and 10?

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

19. A number whose digits are all 1's is called a repunit. For example, 1, 11, and 111 are all repunits.

a. Is 111 prime? Is 1111 prime?

b. Can a repunit other than 11 with an even number of digits be a prime? Justify your answer.

20. Let $f(n)$ denote how many positive integers with digits 1 and/or 2 have n be the sum of their digits. For example, $f(4) = 5$ because there are 5 such integers (1111, 112, 121, 211, and 22)

a. What pattern is made by the values in the sequence $f(1), f(2), f(3), f(4), f(5), \ldots$?

b. Prove that the pattern holds forever.