

Directions: Show all work for credit. Write all responses on separate paper. Do not use a calculator.

1. List the elements of each set in roster form.
  - a.  $\{x \mid x \text{ is a prime number less than } 10 \text{ and } x \text{ is factor of } 1100\}$
  - b.  $\{x \mid x \text{ is a prime number less than } 10 \text{ or } x \text{ is factor of } 1100\}$
2. Factor each number as a product of prime numbers:
  - a. 40
  - b. 3850
3. Simplify the expression. Remember to follow the order of operations, one small step at a time.
  - a.  $\frac{10 - 2(3 - 17)}{10 - 4 \cdot 2 + 5}$
  - b.  $2 - 5[2 - 5(2x - 5)]$

4. The following table gives the number of fatal crashes involving drivers aged 15-20 in the United States in each of the years listed

Year	2002	2003	2004	2005	2006	2007
Fatal Crashes	7970	7590	7600	7160	7180	6670

On the basis of these data, a statistician suggests that the following formula can be used to approximate the number of young drivers,  $N$ , involved in fatal crashes:

$$N = 150x^3 - 1130x^2 + 2350x + 6220$$

where  $x = 0$  corresponds to 2002,  $x = 1$  corresponds to 2003, and so on.

- a. Use this formula to compute  $N$  for the year 2006.
  - b. What is the error in the formula's approximation of  $N$ ?
5. Simplify the expression  $b^3 - 2a(a + b) - b(2a + b^2)$  by writing a sequence of equal, successively simpler expressions.
6. Factor the expression  $6x^3 + 9x$  by factoring out the greatest common factor.
7. Evaluate  $xy^2 - 2x^2$  for  $x = -1.7$  and  $y = 1.1$  and round to the nearest tenth.
8. Let  $n$  represent the number and express the quantity that is the product of 5 less than twice the number with seven more than three times the number.
9. Write an equation that says that seventeen less than a number is eight more than four times the number.
10. Express the total value, in cents, of a dollar and  $Q$  quarters.

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- List the elements of each set in roster form.
  - $\{x \mid x \text{ is a prime number less than 10 and } x \text{ is factor of 1100}\}$   
 SOLN:  $1100 = 2^2 \cdot 5^2 \cdot 11$  so this set is  $\{2, 5\}$
  - $\{x \mid x \text{ is a prime number less than 10 or } x \text{ is factor of 1100}\}$   
 SOLN:  $\{1, 2, 3, 4, 5, 7, 10, 11, 20, 22, 25, 44, 50, 55, 100, 110, 200, 220, 275, 550, 1100\}$
- Factor each number as a product of prime numbers:
  - $40 = 2^3 \cdot 5$
  - $3850 = 2 \cdot 5^2 \cdot 7 \cdot 11$
- Simplify the expression. Remember to follow the order of operations, one small step at a time.
  - $\frac{10 - 2(3 - 17)}{10 - 4 \cdot 2 + 5} = \frac{10 - 2(-14)}{10 - 8 + 5} = \frac{10 + 28}{2 + 5} = \frac{38}{7} = 5\frac{3}{7} = 5.428571$
  - $2 - 5[2 - 5(2x - 5)] = 2 - 5(2 - 10x + 25) = 2 - 5(27 - 10x) = 2 - 135 + 50x = \boxed{50x - 133}$
- The following table gives the number of fatal crashes involving drivers aged 15-20 in the United States in each of the years listed

Year	2002	2003	2004	2005	2006	2007
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$$N = 150x^3 - 1130x^2 + 2350x + 6220$$

where  $x = 0$  corresponds to 2002,  $x = 1$  corresponds to 2003, and so on.

- Use this formula to compute  $N$  for the year 2006.  
 SOLN:  $N = 150(4)^3 - 1130(4)^2 + 2350(4) + 6220 = 150(64) - 1130(16) + 9400 + 6220$   
 $= 9600 - 18080 + 13620 = -8480 + 15620 = \boxed{7140}$
  - What is the error in the formula's approximation of  $N$ ?  
 SOLN: The error is an underestimate by 40. This is approximately a 0.6% of the value.
- Simplify the expression  $b^3 - 2a(a+b) - b(2a+b^2)$  by writing a sequence of equal, successively simpler expressions.  
 SOLN:  $b^3 - 2a(a+b) - b(2a+b^2) = b^3 - 2a^2 - 2ab - 2ab - b^3 = \boxed{-2a^2 - 4ab}$
  - Factor the expression  $6x^3 + 9x$  by factoring out the greatest common factor.  
 SOLN:  $6x^3 + 9x = 3x(2x^2 + 3)$
  - Evaluate  $xy^2 - 2x^2$  for  $x = -1.7$  and  $y = 1.1$  and round to the nearest tenth.  
 SOLN:  $-1.7(1.1)^2 - 2(-1.7)^2 = -1.7(1.21) - 2(2.89) = -2.057 - 5.78 = -7.837 \approx \boxed{-7.8}$
  - Let  $n$  represent the number and express the quantity that is the product of 5 less than twice the number with seven more than three times the number.  
 SOLN:  $(2n - 5)(3n + 7)$
  - Write an equation that says that seventeen less than a number is eight more than four times the number. SOLN:  $n - 17 = 4n + 8$
  - Express the total value, in cents, of a dollar and  $Q$  quarters.  
 SOLN:  $100 + 25Q$ .