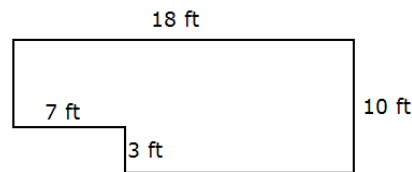


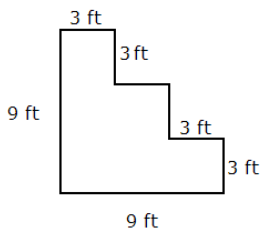
- Consider a rectangle with sides 5 m and 12 m long.
 - Compute the perimeter of the rectangle. Include units in your computation and answer.
 - Compute the area of the rectangle. Include units in your computation and answer.

- Consider the object shown on the picture.

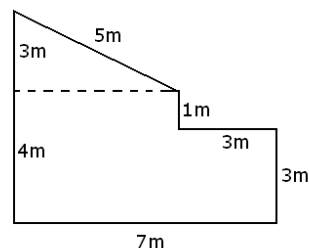
- Compute the perimeter of the object in feet.
Include units in your computation and answer.
- Compute the area of the object in square feet.
Include units in your computation and answer.



- In each case, compute the area of the object shown on the picture. Include units in your computation and answer.



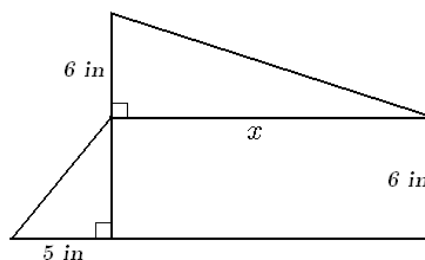
a)



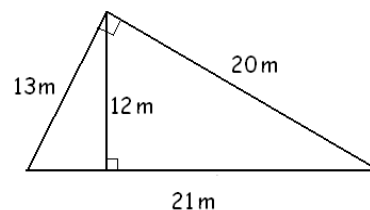
b)

- Which of the following numbers is a prime number? 411, 511, 611, 711, 811, 847
- What is the last digit of 7^{99} ?
- Find the smallest positive integer that gives a remainder of 1 when divided by 2, a remainder 2 when divided by 3, a remainder 3 when divided by 4, a remainder 4 when divided by 5, and a remainder 5 when divided by 6.
- Find the prime factorization for 2016.
- Suppose that $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $X = \{2, 3, 5, 8\}$, and $Y = \{1, 3, 5, 6\}$. Find each of the following.
 - $\overline{X \cup \overline{Y}}$
 - $\overline{X \cup Y}$
 - $X \cup \overline{X}$
 - $X \cap \overline{X}$
 - $\overline{X} \cap \overline{Y}$
 - How many subsets does X have?
 - How many proper subsets does U have?
- Suppose that $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, $X = \{2, 3, 5, 8\}$, and $Y = \{1, 3, 5, 6\}$. Label each of the following as true or false.
 - $\emptyset \subseteq X$
 - $X \cap Y \subseteq X$
 - $Y \subseteq X \cup Y$
 - $|X \cup Y| = |X| + |Y|$
 - $X \cup Y \subseteq X \cap Y$
- Suppose that $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$. Find each of the following sets.
 - $A = \{x \in U : x \text{ is divisible by } 3\}$
 - $B = \{x \in U : x \text{ is divisible by } 2 \text{ or } x \text{ is a prime}\}$
 - $C = \{x \in U : x \text{ is divisible by } 2 \text{ and } x \text{ is a prime}\}$
 - $D = \{x \in U : x < 8 \text{ or } x \geq 2\}$
 - $E = \{x \in U : x < 8 \text{ and } x \geq 2\}$
 - $F = \{x \in U : x \geq 11 \text{ or } x \text{ is a prime}\}$
 - $G = \{x \in U : x \geq 11 \text{ and } x \text{ is a prime}\}$
- List all subsets of $A = \{1, 2, 3, 4\}$
- List all two-element subsets of $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$.

13. Find the prime factorization for x if
 a) $x = 30^{20}$ b) $x = 72^{10}$ c) $x = 15!$ ($15! = 15 \cdot 14 \cdot 13 \cdot \dots \cdot 2 \cdot 1$)
14. What is the greatest prime factor of $20!$?
15. Label each of the following statements as true or false.
 a) Every integer greater than 1 is either a prime or a composite.
 b) If n^2 is divisible by 12, then n^2 is divisible by 36.
 c) If n^3 is divisible by 2, then it is also divisible by 8.
 d) The sum of two prime numbers is never a prime.
 e) If a number n is divisible by 10 and by 12, then it is also divisible by 120.
 f) There is a number less than 100 that is divisible by all of 1, 2, 3, 4, 5, and 6.
 g) If n is a natural number, the all exponents in the prime factorization of n^3 are divisible by 3.
16. Find the value of x if we know that the object shown on the picture has area 195 in^2 . (Hint: Set up and solve an equation expressing the area!)



17. Perform the given operations.
 a) $-100 + (-99) + (-98) + \dots + 97 + 98 + 99$ b) $-100(-99)(-98) \cdot \dots \cdot 97 \cdot 98 \cdot 99$
18. Perform the indicated operations and simplify.
 a) $\frac{-2^2 - (-2)^3 - (-2)^4}{1 - 3(4 - 5(-3^2 - 2(-5)))}$ d) $(-1)^{200} + (-1)^{201} + (-1)^{400}$ i) $\sqrt{25} - \sqrt{16}$
 b) $\sqrt{4} - \frac{30}{1 - \frac{4}{-6^2 - 5(-7)}}$ e) $|2 - 3|-8||$ j) $(\sqrt[5]{2})^5$
 c) $\left(\frac{(-5^2 - 3(-7))^2 - 2(-7)}{(-3)^2 - (-1)^3}\right)^2$ f) $|2 - |3 - 8||$ k) $(\sqrt[5]{2})^{15}$
 h) $\sqrt{25 - 16}$ l) $(\sqrt[6]{3})^{24}$
19. The order of operations problem $|2 - 3|-8 - 2(-5)| - 7|$ is not well-defined because it can be solved in two different ways. Work out both possibilities. What are the two different results?
20. Compute the perimeter and area of the triangle shown on the picture. Include units in your computation and answer.



21. Consider the equation $x^4 - 4x^3 + 19x = -x^3 + 15(x^2 - 2)$. Find all numbers from this list that are solutions of the equation: $-4, -3, -1, 0, 1, 2, 3, 4, 5$

22. Simplify each of the following.

a) $(-2x + 8y) + (5x - 8y)$

e) $(-2x + 8y)^2 - (5x - 8y)^2$

i) $(3x^5 - 2)(3x^5 + 2)$

b) $(-2x + 8y) - (5x - 8y)$

f) $(5x - 1)^2 - (3x - 2)(2x - 1)$

j) $(x - 3)^2$

c) $-3(-2x + 8y) - 2(5x - 8y)$

g) $(-2x + 3)^2 - (2x - 3)^2$

k) $(x - 3)^3$

d) $(-2x + 8y)(5x - 8y)$

h) $(2m^3 + 5)^2 + (2m^3 - 5)^2$

l) $(x - 3)^4$

23. Simplify each of the following.

a) $\frac{(x^3 \cdot x^5)^4}{(-x^3)^2 (-x)^5}$

b) $\frac{(xy)^2 (xy)^3}{(xy^2)(xy^3)}$

c) $\left(\frac{-2x^5 y^7 (3xy)^2}{(-2xy)^3 (-3xy^2)^2} \right)$

24. Solve each of the given equations. Make sure to check your solutions.

a) $3(x - 8) - 8(x - 3) = 5(x - 12)$

e) $(2y - 5)(y - 1) - (y - 3)^2 = 5(y - 2) - 3$

b) $\frac{x + 7}{2} - 3 + 1 = -2$

f) $(2x - 3)^2 - (3x + 1)(x - 5) = 2 + x(x + 5)$

c) $5(x - 1) - 3(2x + 5) = -2(x - 4)$

g) $a^2 - 3a(a - 1) = 7 - (2a - 1)(a + 5)$

d) $(3y - 1)^2 - 5(y - 2)^2 = (2y + 3)^2$

h) $5x - 4 - 2(3x - 5) = 2(5x + 3)$

i) $2w - 3(5 - w) = 5(w - 3)$

j) $2x - 2(3(1 - (5 - x) + x) - 2x) - 5x = 2(3 - 2(3x - 1))$

k) $2x - 3(4x - 5(2x - 1)) = 4 - 2(3 - 5(2x - 1))$

25. Simplify the expression $2^n + 2^n$. (Hint: try $n = 1, 2, 3, 4, \dots$)

Answers

1. a) $P = 34 \text{ m}$ b) $A = 60 \text{ m}^2$
2. a) $P = 56 \text{ ft}$ b) $A = 159 \text{ ft}^2$
3. a) 54 ft^2 b) 31 m^2 4. 811 5. 3
6. 59 7. $2016 = 2^5 \cdot 3^2 \cdot 7$
8. a) $\{1, 2, 4, 6, 7, 8, 9, 10\}$ b) $\{4, 7, 9, 10\}$
 c) $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ d) \emptyset e) $\{4, 7, 9, 10\}$
 f) 16 g) 1023
9. a) true b) true c) true d) false e) false
10. a) $\{3, 6, 9, 12\}$ b) $\{2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13\}$
 c) $\{2\}$ d) U e) $\{2, 3, 4, 5, 6, 7\}$
 f) $\{2, 3, 5, 7, 11, 12, 13\}$ g) $\{11, 13\}$
11. All subsets of $A = \{1, 2, 3, 4\}$:
 0-element subsets: \emptyset
 1-element subsets: $\{1\}, \{2\}, \{3\}, \{4\}$
 2-element subsets: $\{1, 2\}, \{1, 3\}, \{1, 4\}, \{2, 3\}, \{2, 4\}, \{3, 4\}$
 3-element subsets: $\{1, 2, 3\}, \{1, 2, 4\}, \{1, 3, 4\}, \{2, 3, 4\}$
 4-element subsets: $\{1, 2, 3, 4\}$
12. All two-element subsets of $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$:
 $\{1, 2\}$
 $\{1, 3\} \quad \{2, 3\}$
 $\{1, 4\} \quad \{2, 4\} \quad \{3, 4\}$
 $\{1, 5\} \quad \{2, 5\} \quad \{3, 5\} \quad \{4, 5\}$
 $\{1, 6\} \quad \{2, 6\} \quad \{3, 6\} \quad \{4, 6\} \quad \{5, 6\}$
 $\{1, 7\} \quad \{2, 7\} \quad \{3, 7\} \quad \{4, 7\} \quad \{5, 7\} \quad \{6, 7\}$
 $\{1, 8\} \quad \{2, 8\} \quad \{3, 8\} \quad \{4, 8\} \quad \{5, 8\} \quad \{6, 8\} \quad \{7, 8\}$
 $\{1, 9\} \quad \{2, 9\} \quad \{3, 9\} \quad \{4, 9\} \quad \{5, 9\} \quad \{6, 9\} \quad \{7, 9\} \quad \{8, 9\}$
 $\{1, 10\} \quad \{2, 10\} \quad \{3, 10\} \quad \{4, 10\} \quad \{5, 10\} \quad \{6, 10\} \quad \{7, 10\} \quad \{8, 10\} \quad \{9, 10\}$
13. a) $2^{20} \cdot 3^{20} \cdot 5^{20}$ b) $2^{30} \cdot 3^{20}$
 c) $2^{11} \cdot 3^6 \cdot 5^3 \cdot 7^2 \cdot 11 \cdot 13$ 14. 19
15. a) true b) true c) true d) false
 e) false f) true g) true 16. $x = 20 \text{ in}$
17. a) -100 b) 0
18. a) -3 b) -4 c) 9 d) 1 e) 22
 f) 3 g) 7 h) 3 i) 1 j) 2 k) 8
 l) 81 19. 11 and 63
20. $P = 54 \text{ m}$ $A = 126 \text{ m}^2$
21. $-3, -1, 2, \text{ and } 5$
22. a) $3x$ b) $-7x + 16y$ c) $-4x - 8y$
 d) $-10x^2 + 56xy - 64y^2$ e) $-21x^2 + 48xy$
 f) $19x^2 - 3x - 1$ g) 0 h) $8m^6 + 50$
 i) $9x^{10} - 4$ j) $x^2 - 6x + 9$
 k) $x^3 - 9x^2 + 27x - 27$
 l) $x^4 - 12x^3 + 54x^2 - 108x + 81$
23. a) $-x^{21}$ b) x^3 c) $\frac{x^2y^2}{4}$
24. a) 6 b) -31 c) 28 d) 14 e) 3
 f) 4 g) 1 h) 0 i) all real numbers
 j) -14 k) there is no solution
25. 2^{n+1}