

Exponents

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Overview

Exponents are used to represent repeated multiplication in the same way that multiplication is used to represent repeated addition. In the expression 5^2 , 5 is the base and 2 is the exponent. For x^a , x is the base and a is the exponent. 5^2 means $5 \cdot 5$ and 5^3 means $5 \cdot 5 \cdot 5$.

Examples

1. Rewrite $6 \cdot 6 \cdot 6 \cdot 6$ with an exponent.

$$6 \cdot 6 \cdot 6 \cdot 6 = 6^4$$

2. Use multiplication to rewrite 3^7 .

$$3^7 = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 2,187$$

3. Use the Order of Operations to rewrite $9^2 - 56$.

$$\begin{aligned} 9^2 - 56 \\ = 9 \cdot 9 - 56 \\ = 81 - 56 \\ = 25 \end{aligned}$$

Practice

Rewrite each expression using multiplication or with a different exponent.

1. 2^5

2. 3^4

3. 9^2

Use the Order of Operations to rewrite each expression.

4. $15 + 9^2 - 56$

5. $15 + 9^2 - 56 \div 8$

6. $32 \div 2^3$

7. $32 \div 2^3 + \frac{16-4}{6}$

8. $32 \div 2^3 + \frac{16-4}{6} + 7$

9. $2^3 + \frac{16-4}{6} + 7$

10. $2^3 + \frac{20}{6+4} + 7$

11. $9(2) \div 6 + (6-1)^2$

12. $4^2 + 9(2) \div 6 + (6-1)^2$

13. $4^2 + \frac{9(2)}{3} \div 6 + (6-1)^2$

14. $4^2 + \frac{9(2)}{3} \div 6 + 3(6-1)^2$

Answers

1. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$

2. $3 \cdot 3 \cdot 3 \cdot 3 = 81$

3. 81

4. 40

5. 89

6. 4

7. 6

8. 13

9. 17

10. 17

11. 28

12. 44

13. 42

14. 92

Volume and Surface Area of Prisms

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Overview

The surface area of a prism is the sum of the areas of all of its faces, including the bases. Surface area is expressed in square units. A net is a drawing of each of the faces of a solid, as if it were cut along some of its edges and flattened out, but leaving the faces connected.

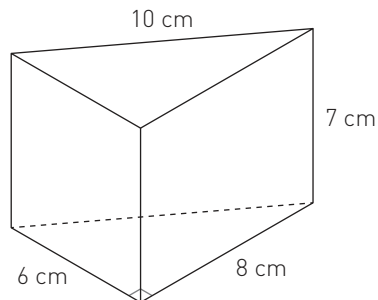
Volume is a three-dimensional property. It measures the amount of interior space in a three-dimensional figure based on a cubic unit, or in other words, the number of 1-by-1-by-1-unit cubes that will fit inside the figure. The volume of a prism is calculated by multiplying the area of either base, B , by the height, h , of the prism.

$$\text{Volume} = (\text{area of base}) \cdot (\text{height}) \text{ or } V = Bh$$

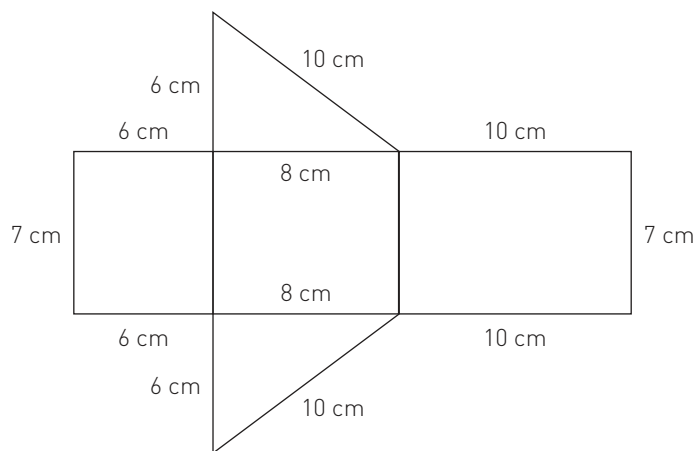
For additional information, see the Methods & Meanings boxes in Lesson 9.3.1 and Lesson 9.3.2 of the *Core Connections Course 1* text.

Examples

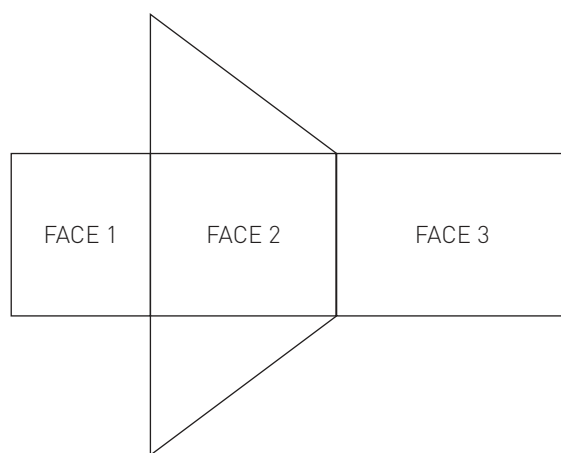
1. Calculate the surface area of the right triangular prism.



Representing the prism using a net makes it easier to see all of the faces.



$$\text{Area of the two bases: } 2\left[\frac{1}{2}(6 \cdot 8)\right] = 48 \text{ cm}^2$$



Area of the three lateral faces:

$$\text{Area of face 1: } 6 \cdot 7 = 42 \text{ cm}^2$$

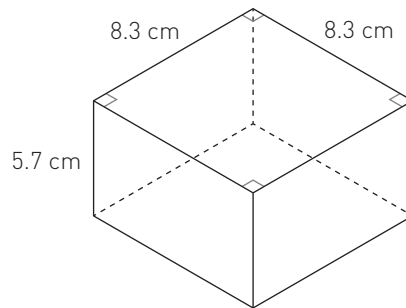
$$\text{Area of face 2: } 8 \cdot 7 = 56 \text{ cm}^2$$

$$\text{Area of face 3: } 10 \cdot 7 = 70 \text{ cm}^2$$

Surface area of prism:

$$48 + 42 + 56 + 70 = 216 \text{ cm}^2$$

2. Calculate the volume of the prism shown.



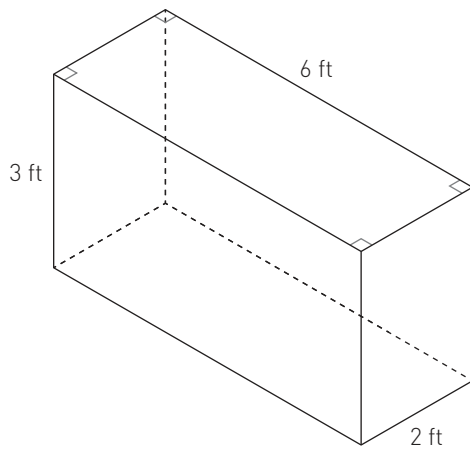
Area of the base: $B = 8.3 \cdot 8.3 = 68.89 \text{ cm}^2$

Height: $h = 5.7 \text{ cm}$

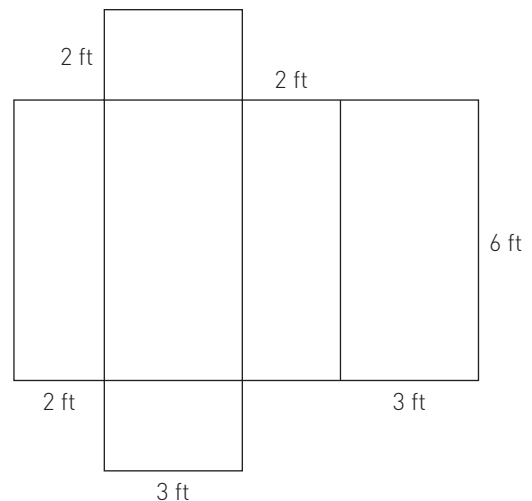
Volume: $V = Bh = (68.89)(5.7) = 392.673 \text{ cm}^3$

Practice

1. Calculate the surface area and volume of the prism shown.

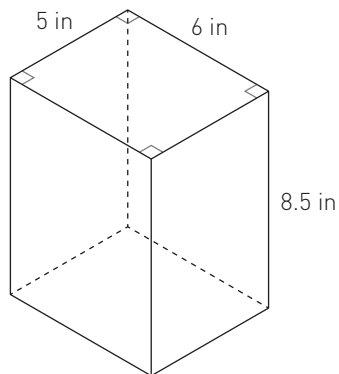


2. Calculate the surface area of the rectangular prism using the net shown.

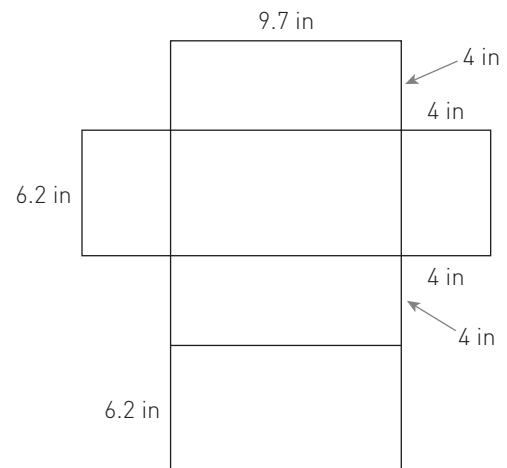


3. Imagine the net from problem 2 was put together to create a three-dimensional rectangular prism (a box). What would be its volume?

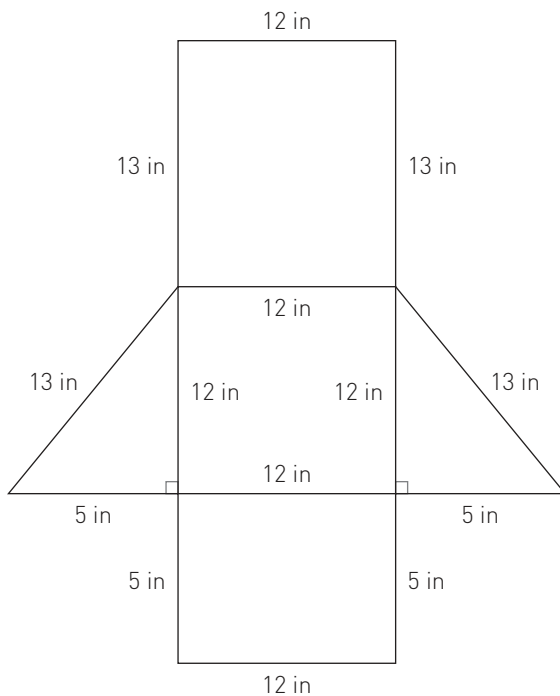
4. Create a net for the rectangular prism shown, then calculate its surface area.



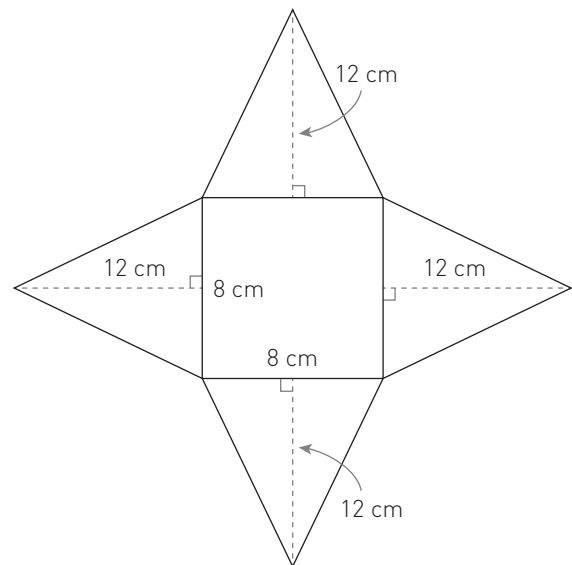
5. Calculate the surface area and volume of the rectangular prism using the net shown.



6. Calculate the surface area of the triangular prism using the net shown.



7. Calculate the surface area of the square pyramid using the net shown.



8. Calculate the volume of a right prism with base area 32 cm^2 and height 1.5 cm .
9. Determine the height of a right prism with base area 32 cm^2 and volume 176 cm^3 .
10. Determine the base area of a right prism with volume 47.01 cm^3 and height 3.2 cm .

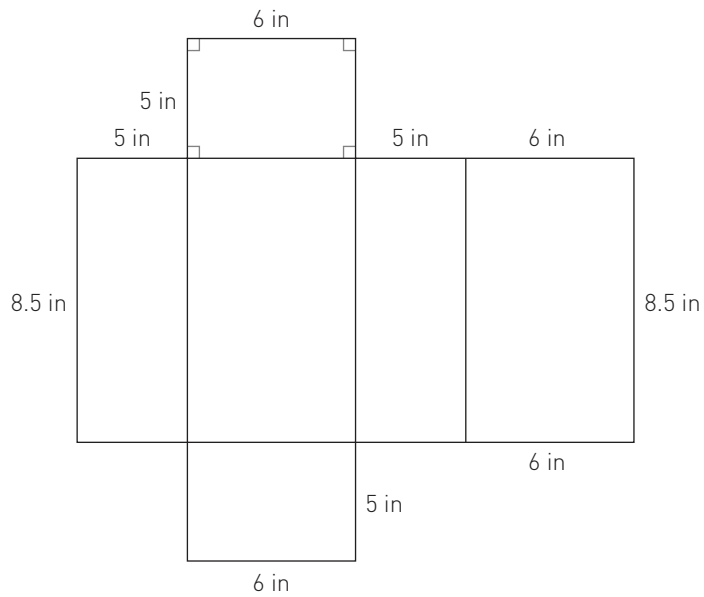
Answers

1. surface area = 72 ft^2 , volume = 36 ft^3

2. 72 ft^2

3. 36 ft^3

4. 247 in^2
Responses may vary.



5. surface area = 247.48 in^2 , volume = 240.56 in^3

6. 420 in^2

7. 256 cm^2

8. 48 cm^2

9. 5.5 cm

10. 14.7 cm^2

Calculating and Using Percents

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Overview

Ratio reasoning can be used to solve problems and determine the missing parts, wholes, or percentages.

Percentages can also be calculated by composition and decomposition of common percents, that is, by breaking numbers into parts and then adding or subtracting the results. This method is particularly useful for doing mental calculations. A percent ruler can also be used for problems when you need to calculate the percent or the whole.

Knowing quick methods to calculate 10% of a number and 1% of a number will help you to calculate other percents by composition. Use the fact that $10\% = \frac{1}{10}$ and $1\% = \frac{1}{100}$.

Examples

1. What is 32% of 40?

32% can be decomposed using 10% and 1%. Therefore, 32% of 40 can be written as $3(10\% \text{ of } 40) + 2(1\% \text{ of } 40)$.

$$10\% \text{ of } 40 \Rightarrow \frac{1}{10} \text{ of } 40 = 4$$

$$1\% \text{ of } 40 \Rightarrow \frac{1}{100} \text{ of } 40 = 0.4$$

$$32\% \text{ of } 40 \Rightarrow 3(4) + 2(0.4) \Rightarrow 12 + 0.8 = 12.8$$

2. What is 9% of 750?

9% can be written as $10\% - 1\%$. Therefore, 9% of 750 can then be written as $(10\% \text{ of } 750) - (1\% \text{ of } 750)$.

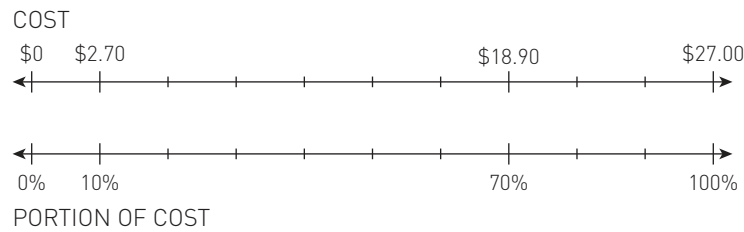
$$10\% \text{ of } 750 \Rightarrow \frac{1}{10} \text{ of } 750 = 75$$

$$1\% \text{ of } 750 \Rightarrow \frac{1}{100} \text{ of } 750 = 7.5$$

$$9\% \text{ of } 750 \Rightarrow 75 - 7.5 = 67.5$$

Other common percents such as $50\% = 12$, $25\% = 14$, $75\% = 34$, $20\% = 15$ could also be useful for composition.

3. Jana purchased a sweater for 70% of the original cost at her local thrift store. If the original price of the sweater was \$27, how much did Jana pay for the sweater?



Every 10% is \$2.70, so $7(\$2.70)$ is 70%. Therefore, 70% of \$27 is \$18.90.

Practice

Solve each problem. Show your work or reasoning.

1. What is 22% of 60?
2. What is 29% of 500?
3. What is 41% of 82?
4. What is 8% of 65?
5. 45 is 30% of what number?
6. What amount is \$1.50 25% of?
7. 60 is what percent of 80?
8. What is 15% of 32?
9. What percent is 16 out of 20?
10. \$10 is what percent of \$25?
11. 30% of what number is 27?
12. 15% of what number is 24?

Calculate using any method. Round to the nearest hundredth as appropriate.

13. 17% of 125.8
14. 32% of 4.825
15. 125% of 49
16. 6.5% of 48
17. 5.2% of 8.7
18. 7% of \$14.95
19. 9% of \$32.95
20. 1.5% of \$3,200
21. 1.65% of \$10,500
22. 120% of 67
23. 167% of 45.8
24. 15% of \$24.96
25. A local high school has a total of 1,150 students. 22% of the student body are 12th graders. How many 12th graders are there at this school?
26. Mariama is running 18 miles to train for a marathon race. She has already run 45% of the total distance. How many miles has Mariama run?
27. A store sells all items by adding an additional 24% to the price the store paid for it. If the store purchased an item for \$73, how much will it sell the item for?

Answers

- | | | | | | |
|-----|--------------|-----|-----------|-----|----------|
| 1. | 13.2 | 2. | 145 | 3. | 33.62 |
| 4. | 5.2 | 5. | 150 | 6. | \$6.00 |
| 7. | 75% | 8. | 4.8 | 9. | 80% |
| 10. | 40% | 11. | 90 | 12. | 160 |
| 13. | 21.386 | 14. | 1.544 | 15. | 61.25 |
| 16. | 3.12 | 17. | 0.4524 | 18. | \$1.05 |
| 19. | \$2.97 | 20. | \$48 | 21. | \$173.25 |
| 22. | 80.4 | 23. | 76.486 | 24. | \$3.74 |
| 25. | 253 students | 26. | 8.1 miles | 27. | \$90.52 |