



Section 1. Perform the following operations.

1. $\frac{4}{9} + \frac{8}{27} =$

2. $10\frac{3}{4} + 15\frac{3}{8} =$

3. $\frac{7}{16} - \frac{1}{4} =$

4. $\frac{3}{8} + \frac{5}{8} \times \frac{1}{2} \div \frac{5}{16} =$

5. $(22-5) \times (16 - 12) =$

6. $10.375 - \frac{1}{4} =$

7. $51.5 \times 2.25 =$

8. $15^2 + (2 + 3)^3 =$



9. $56 + 44 \times 14 =$

10. $\sqrt{4^2 + 3^2} =$

11. What is 20% of 620?

12. What is 21% of 440?

13. What percent is 24 of 70?

14. Express 89 inches in feet and inches.

15. Express 4yds 2ft 6inches in inches alone.

16. $9 \text{ ft } 4 \text{ in} \times 4 =$

17. $12\text{ft } 2\text{in} - 8\text{ft } 8\text{in} =$



18. $120' 3'' + 85' 9 \frac{1}{2}'' + 63' 5 \frac{1}{2}'' =$

19. Convert 120 yards to feet.

20. Convert 125 ft 10in to inches alone.

21. 2.5 Miles to inches.

22. 3100 cc (cu. centimeters) to cubic inches.

23. Convert 145° C to $^{\circ}$ F.

24. Convert 45° F to $^{\circ}$ C.

25. Convert 10 HP to watts.



26. Calculate the area of a floor with a length of 120' by a width of 55'.

27. $(2a^2b^4 + 5cd^3) + (5a^2b^4 - cd^3) =$

28. $(a^3 + b^5)(c + d^2) =$

29. $\frac{25}{a} = \frac{5}{4}$

30. $c^2 - 75 = 550$

31. $\frac{125 + c}{1025} = \frac{2}{5}$

32. $24d = \frac{1}{2}$

33. $4c^2 - 275 = 125$



34. Calculate the area of a circle with a radius of 10.25". $\text{Area} = \pi \cdot r^2$
35. Calculate the area of a right triangle with base of 12" and a height of 18".
 $\text{Area} = \frac{1}{2} b \cdot h$

Section 2. Answer the following word problems.

36. A 20 ampere fuse carries a temporary 10% current overload. How many amps of current flow through the fuse during the overload?
37. A fan is controlled by a variable speed drive and is operating at 95% total capacity and is moving 9000 cfm.
- a) How much air will it move (cfm) at 100% capacity?
- b) How much air will it move (cfm) at 45% capacity?



38. A cylindrical water tank measures 9' long with a radius of 2', and is 75% full. How many gallons are in the tank?
39. How much electric heat is required, in KW, to heat 2,500 cfm of air from 40°F to 75°F? Use the following formula:
BTU/Hr = CFM x 1.08 x (T₂ - T₁)
40. Find R_{Total} for a parallel circuit with the following five resistors R₁ = 250 Ω, R₂ = 100 Ω, R₃ = 450 Ω, R₄ = 500 Ω, R₅ = 650 Ω .

$$R_{Total} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}}$$

41. How many amps should a 20kw duct heater draw when connected to a 460v 3 phase circuit?

The formula for power for a three phase heater is:

$$Kw = \frac{Volts \times Amps \times 1.73}{1000}$$

42. Code dictates that the free area for a direct opening to the outdoors to provide combustion air shall be 1 in² per 4,000 BTU/Hr.
- a) How big of a louver, in in², do we need for a boiler with an input rating of 850,000 BTU?
- b) If the louver has 25% restriction, what is the adjusted total area, in in², of the louver?



Length	
12 inches	= 1 foot
3 feet	= 1 yard
5280 feet	= 1 mile
1760 yards	= 1 mile
1 inch	= 2.54 centimeters
Volume	
1728 cu. inches	= 1 cubic foot
27 cu. feet	= 1 cubic yard
231 cu. inches	= 1 gallon
61 cu. Inches	= 1 litre
Mass	
437.5 grains	= 1 ounce
16 ounces	= 1 pound
2000 pounds	= 1 short ton
1 Gall of water	= 8.34 lbs
1 Kilogram	= 2.2 lbs

Area	
144 sq. inches	= 1 square foot
9 sq. feet	= 1 square yard
4840 sq. yards	= 1 acre
640 acres	= 1 square mile

Capacity	
16 fluid ounces	= 1 pint
2 pints	= 1 quart
4 quarts	= 1 gallon

Time	
60 seconds	= 1 minute
60 minutes	= 1 hour
24 hours	= 1 day

1 BTU/hr	= .293 Watt/hr
1 ton cooling	= 12,000 BTU/hr
1 HP	= 746 Watt/hr

Energy	
1 cu ft of Natural Gas	= 1030 BTU/hr
1000 watts/hr	= 1 Kw/hr

Note that when converting area units:

1 foot = 12 inches
 $(1 \text{ foot})^2 = (12 \text{ inches})^2$ (square both sides)

1 foot² = 144 inches²
 The linear & area relationships are not the same!

Note that when converting volume units:

1 foot = 12 inches
 $(1 \text{ foot})^3 = (12 \text{ inches})^3$ (cube both sides)

1 foot³ = 1728 inches³
 The linear & volume relationships are not the same!

Length	
1,000 millimetres	= 1 meter
100 centimetres	= 1 meter
1,000 meters	= 1 kilometer

Area	
100 sq. mm	= 1 sq. cm
10 000 sq. cm	= 1 sq. metre
100 sq. metres	= 1 are

Volume	
1000 cu. mm	= 1 cu. cm
1 million cu. cm	= 1 cu. metre

Capacity	
10 millilitres	= 1 centilitre
1000 cu. cm.	= 1 litre
1000 litres	= 1 cu. metre

Mass	
1000 grams	= 1 kilogram

Formulas

Area	
Rectangle	A = Length x Width
Circle	A = Π x Radius ²
Triangle	A = $\frac{1}{2}$ Base x Height
	$\Pi = 3.14$

Right Triangle
 $C^2 = A^2 + B^2$

Electricity

$V = I \times R$ $P = I \times E$
 Parallel Resistors $R_{\text{Total}} = 1 \div (1/R_1 + 1/R_2 + \dots)$

Volume	
Rect. Box	V = Length x Width x Height
Sphere	V = $\frac{4}{3}$ x Π x Radius ³
Cyl. Tank	V = Π x Radius ² x Length
Circ. of a Circle	= 2 x Π x Radius

Temperature
 $^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$ $^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$

Answers

1. $20/27$
2. $26 \frac{1}{8}$
3. $3/16$
4. $1 \frac{3}{8}$
5. 68
6. 10.125 or $10 \frac{1}{8}$
7. 115.875
8. 350
9. 672
10. 5
11. 124
12. 92.4
13. 34.29%
14. 7' 5"
15. 174
16. 37' 4"
17. 3' 6"
18. 269' 6"
19. 360'
20. 1510"
21. 158,400"
22. 189.1 in^3
23. 293°F
24. 7.2°C
25. 7460 watts
26. $6,600 \text{ ft}^2$
27. $7a^2b^4 + 4cd^3$
28. $a^3c + a^3d^2 + b^5c + b^5d^2$
29. $a=20$
30. $c=25$
31. $c=285$
32. $d=1/48$
33. $c=10$
34. $a=329.9 \text{ in}^2$
35. 108 in^2
36. 22 amps
37. a) 9,473.7 cfm b) 4263.2 cfm
38. 634.2 gallons
39. 27.69 kw
40. 50.61 ohms
41. 25.13 amps
42. a) 212.5 in^2 b) 283.33 in^2