

Geometry

(# 1) For a convex polygon with n sides:

$$\text{the sum of the measures of the interior angles} = (n - 2) \cdot 180^\circ$$

P = perimeter; A = area; V = volume, SA = surface area

(# 2) For any rectangle: $A = \text{length} \cdot \text{width}$

(# 3) For any rectangle: $P = 2 \cdot \text{length} + 2 \cdot \text{width}$

(# 4) For any parallelogram: $A = \text{base} \cdot \text{height}$

(# 5) For any trapezoid: $A = \frac{1}{2} h (b_1 + b_2)$, where b_1 and b_2 are the lengths of two bases, h = height of a trapezoid

(# 6) For any triangle: $A = \frac{1}{2} \cdot \text{base} \cdot \text{height}$

(# 7) For any triangle: (Heron's formula): $A = \sqrt{s(s-a)(s-b)(s-c)}$,

where $s = \frac{1}{2}(a+b+c)$, and a, b, c are lengths of three sides

(# 8) For any right triangle (Pythagorean Theorem): $(\text{leg}_1)^2 + (\text{leg}_2)^2 = (\text{hypotenuse})^2$

(# 9) For any circle with radius r : $A = \pi r^2$

(# 10) For any circle with radius r : Circumference = $P_{\text{circle}} = 2\pi r = \pi \cdot \text{diameter}$

(# 11) For any rectangular solid (rectangular parallelepiped) with length l , width w , and height h :
 $V = \text{length} \cdot \text{width} \cdot \text{height}$

(# 12) For any rectangular solid (rectangular parallelepiped) with length l , width w , and height h :
 $SA = 2lw + 2lh + 2wh$

(# 13) For any circular cylinder: $V = \pi r^2 \cdot \text{height}$

(# 14) For any circular cylinder: total $SA = 2\pi rh + 2\pi r^2$

(# 15) For any right circular cone: $V = \frac{1}{3} \pi r^2 \cdot \text{height}$

(# 16) For any right circular cone: $SA = \pi r^2 + \pi r \sqrt{r^2 + h^2}$

(# 17) For any sphere: $V = \frac{4}{3} \pi r^3$

(# 18) For any sphere: $SA = 4\pi r^2$

(# 19) In general, for a 3-dimensional figure with a flat top and base and sides perpendicular to the base, we can find the volume by: $V = A_{\text{base}} \cdot \text{height}$

US customary system and the metric system

In the metric system: Basic unit of length = 1 meter (m)
 Basic unit of volume = 1 liter (l)
 Basic unit of mass (weight) = 1 gram (g)

metric prefixes (Table 1)

kilo (k)	hecto (h)	deka (da)	base unit	deci (d)	centi (c)	milli (m)
$\times 1000$	$\times 100$	$\times 10$		$\times \frac{1}{10}$	$\times \frac{1}{100}$	$\times \frac{1}{1000}$
or $\times 10^3$	or $\times 10^2$	or $\times 10^1$		or $\times 10^{-1}$	or $\times 10^{-2}$	or $\times 10^{-3}$

Example of reading the Table 1:

1 kilometer (km) = 1000 meters (m)

1 centimeters (cm) = $\frac{1}{100}$ meter (m)

Table 2

	Length	Volume	Weight
some conversions within the US customary system:	1 mile (mi) = 5280 feet (ft) 1 yard (yd) = 3 feet (ft) 1 foot (ft) = 12 inches (in)	2 cups = 1 pint 2 pints = 1 quart 32 fluid ounces = 1 quart 4 quarts = 1 gallon	16 ounces = 1 pound 2000 pounds = 1 ton
some conversions between the US customary system and the metric system:	1 inch = 2.54 cm 1 foot = 30.48 cm 1 yard = 0.9144 m 1 mile = 1.6 km	1 liter = 1 cubic decimeter 1 cup = 0.2366 liters 1 quart = 0.9464 liters 1 liter = 1.0567 quarts 1 cubic ft = 0.03 cubic m 1 cubic yd = 0.765 cubic m	1 ounce = 28 grams 2.2 pounds = 1 kg 1 metric tonne = 1000 kg 1.1 tons = 1 metric tonne 1 pound = 454 grams

Consumer Mathematics

(# 20) percent of change = $\frac{\text{new amount} - \text{base amount}}{\text{base amount}}$

(# 21) Simple Interest $I = Prt$

(# 22) Future Value of a Simple Interest Account: $A = P + I = P(1 + rt)$

(# 23) Future Value of Compound Interest Account (compounded periodically): $A = P \left(1 + \frac{r}{m} \right)^n$

where m = the number of compounding cycles per year, n = the total number of compounding cycles

(# 24) Future Value of a Continuous Compound Interest: $A = Pe^{rt}$

Add-on Interest Method for an Installment loan

(# 25) monthly payment = $\frac{P+I}{n}$, where P = amount of the loan, I = interest due of the loan,
 n = the number of monthly payments

The Unpaid balance Method for computing the Finance Charges on a Credit Card Loan

(# 26) finance charges $I = Prt$

(# 27) P = previous month's balance + finance charges + purchases made – returns – payments,
 where r = annual interest rate, and $t = \frac{1}{12}$

(# 28) The Average Daily Balance Method for computing the Finance Charge on a Credit Card Loan

1. Add the outstanding balance for your account for each day of the month
2. Divide the total in step 1 by the number of days in the month to find the average daily balance
3. To find finance charges use $I = Prt$, where P = the average daily balance, r = annual interest rate,
 and $t = \frac{\text{the number of days in the month}}{365}$

Annuities that Grow (account balance increases over time)

(# 29) $R = \frac{A \left(\frac{r}{m} \right)}{\left(1 + \frac{r}{m} \right)^n - 1}$	A is the future value of the account R is the fixed periodic transaction (deposit) <i>r</i> is the interest rate as a decimal <i>m</i> is number of compound periods in a year <i>n</i> is the total number of regular transactions
(# 30) $A = \frac{R \cdot \left[\left(1 + \frac{r}{m} \right)^n - 1 \right]}{\left(\frac{r}{m} \right)}$	

Annuities that Decay (account balance decreases over time)

(# 31) Amortization of a loan: $R = \frac{P \left(\frac{r}{m} \right) \left(1 + \frac{r}{m} \right)^n}{\left(1 + \frac{r}{m} \right)^n - 1}$	P = the present value of the account R = regular periodic payment to amortize the loan (or the amount of the regular periodic withdraw) <i>r</i> is the interest rate as a decimal <i>m</i> is number of compound periods in a year <i>n</i> is the total number of regular transactions
(# 32) Present Value of an Annuity: $P = \frac{R \cdot \left[\left(1 + \frac{r}{m} \right)^n - 1 \right]}{\left(\frac{r}{m} \right) \left(1 + \frac{r}{m} \right)^n}$	

Refinancing

(# 33) Remaining Balance: $U = P \left(1 + \frac{r}{m} \right)^n - R \frac{\left(1 + \frac{r}{m} \right)^n - 1}{\frac{r}{m}}$	<i>R</i> = fixed periodic regular payment (in \$) P = the amount of the loan <i>r</i> = annual interest rate (expressed in decimal notation for computations) <i>m</i> is number of compound periods in a year <i>n</i> is the number of payments already made
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Statistics

Population size = N

Sample size = n

(# 34) Population mean: $\mu = \frac{\sum x}{N}$

(# 35) Sample mean: $\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n} = \frac{\sum x}{n}$

(# 36) Population variance: $\sigma^2 = \frac{\sum (X - \mu)^2}{N}$

(# 37) Sample variance: $s^2 = \frac{\sum (x - \bar{x})^2}{n-1}$

(# 38) Population standard deviation: $\sigma = \sqrt{\sigma^2}$

(# 39) Sample standard deviation: $s = \sqrt{s^2}$

(# 40) Range = max – min

(# 41) Inter-quartile range: $IQR = Q_3 - Q_1$

(# 42) To find z-score for a given x value: $z = \frac{x - \bar{x}}{s}$ or $z = \frac{x - \mu}{\sigma}$

(# 43) To find x-value for a given z-score: $x = \bar{x} + zs$ or $x = \mu + z\sigma$

(# 44) **Empirical Rule** (68-95-99.7 Rule): For any bell-shaped symmetric distribution:

- Approximately 68% of the data value occur within $\bar{x} \pm 1s$ (or $\mu \pm 1\sigma$)
- Approximately 95% of data values lie within $\bar{x} \pm 2s$ (or $\mu \pm 2\sigma$)
- Approximately 99.7% of data values lie within $\bar{x} \pm 3s$ (or $\mu \pm 3\sigma$).

Probability

(# 45) For any event A: $0 \leq P(A) \leq 1$

(# 46) For any sample space: $P(S) = 1$

(# 47) For any empty event $\emptyset$, $P(\emptyset) = 0$

(# 48) **Complement Rule** (corresponds to operator NOT):

For any event E , $P(\text{not } E) = P(E') = 1 - P(E)$

(# 49) **Conditional probability**: The probability of an event A to occur, **given** that event B has occurred:

$$P(A|B) = \frac{P(A \text{ AND } B)}{P(B)}, \text{ when } P(B) \neq 0.$$

(# 50) **General Multiplication Rule** (corresponds to operator AND, symbol $\cap$, intersection):

For any two events A and B, $P(A \text{ AND } B) = P(A) \cdot P(B|A)$

(# 51) Special case for Multiplication Rule:

If A and B are independent events, then $P(A \text{ AND } B) = P(A) \cdot P(B)$

(# 52) **General Addition Rule** (corresponds to operator OR, symbol $\cup$, union):

For any two events A and B, $P(A \text{ OR } B) = P(A) + P(B) - P(A \text{ AND } B)$

(# 53) Special case for Addition Rule:

If events A and B are mutually exclusive (disjoint), then $P(A \text{ OR } B) = P(A) + P(B)$.

(# 54) If an event A is **independent** of an event B, then the following are true:

$$P(A|B) = P(A) \quad P(B|A) = P(B) \quad P(A \text{ AND } B) = P(A) \cdot P(B)$$

That is, to check for independence of any two events, you must check at least one of the properties above.

If at least one of these properties is satisfied, then we can conclude that two events are independent.

If at least one of these properties failed, then we can conclude that two events are dependent.

Odds

Whole number : Whole number (reduced when possible)

Hints for starting to find the Odds FOR (in favor of) an event E :

(# 55) Number of ways an event E can occur : Number of ways an event E cannot occur

(# 56) Number of ways an event E can occur : Number of ways an event E' can occur

(# 57) $P(E) : P(E')$

Hints for starting to find the Odds AGAINST an event E :

(# 58) Number of ways an event E cannot occur : Number of ways an event E can occur

(# 59) Number of ways an event E' can occur : Number of ways an event E can occur

(# 60) $P(E') : P(E)$

(# 61) Expected Value $E(X) = \sum x \cdot P(x)$