

Grade 10 Math — formula sheet

Ratios, lines, shapes, trigonometry and money · 58 formulas · metric edition 1

MODULE 1 · PROPORTION & PERCENT

Math 10-1 Unit Price (Price per Unit Quantity)

$$p = \frac{C}{m}$$

Price per unit of quantity, the number that makes two package sizes comparable on a shelf.

Math 10-2 Percent Change

$$c = \frac{x_{\text{new}} - x_{\text{old}}}{x_{\text{old}}}$$

Relative change from an old value to a new one, as a fraction of the old value.

Math 10-3 Recipe Scaling (Ingredient for a New Yield)

$$Q_2 = Q_1 \cdot \frac{S_2}{S_1}$$

Ingredient quantity rescaled from the yield a recipe was written for to the yield you actually want.

Math 10-4 Map Scale to Real Distance

$$d = mS$$

Real distance from a map measurement times the scale denominator.

Math 10-5 Discount Price (Percentage Off)

$$S = L(1 - d)$$

Price after a percentage is taken off the list price, and the discount implied by any pair of list...

Math 10-6 Sales Tax and Total Price

$$T = P(1 + r)$$

Total payable from a pre-tax price and a tax rate, and the reverse: recovering the pre-tax price...

MODULE 2 · LINEAR RELATIONS & RATES

Math 10-7 Slope Between Two Points

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Steepness of a line as rise over run between two points.

Math 10-8 Slope-Intercept Form of a Line

$$y = mx + b$$

Equation of a straight line from its slope and y-intercept.

Math 10-9 Slope from Standard Form of a Line

$$m = -\frac{A}{B}$$

Slope of a line written in standard form $Ax + By = C$, read straight off the two coefficients...

Math 10-10 x-Intercept of a Line

$$x_{\text{int}} = -\frac{b}{m}$$

Where a line in slope-intercept form crosses the x-axis, found by setting y to zero and solving the...

Math 10-11 Point-Slope Form of a Line

$$y = y_1 + m(x - x_1)$$

Equation of a straight line through one known point with a known slope, giving the y-value at any x...

Math 10-12 Speed, Distance & Time

$$v = \frac{d}{t}$$

Average speed from distance travelled and elapsed time.

Math 10-13 Fuel Consumption (L/100 km)

$$C = \frac{100V}{d}$$

Fuel consumption in litres per hundred kilometres from the fuel burned and the distance covered.

Math 10-14 Miles per Gallon ↔ L/100 km

$$C = \frac{235.215}{M}$$

The reciprocal relation between litres per hundred kilometres and US miles per gallon: their...

Math 10-15 Midpoint Formula

$$x_m = \frac{x_1 + x_2}{2}$$

The coordinate halfway between two endpoints along one axis; apply it to x and again to y for the...

Math 10-16 Distance Formula (2D)

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Straight-line distance between two points in the coordinate plane.

Math 10-17 Pythagorean Theorem

$$a^2 + b^2 = c^2$$

Relates the three sides of a right triangle.

MODULE 3 · AREA & PERIMETER

Math 10-18 Rectangle Area

$$A = l \cdot w$$

Area of a rectangle as length times width.

Math 10-19 Area of a Triangle

$$A = \frac{1}{2}bh$$

Area from base and perpendicular height.

Math 10-20 Area of a Circle

$$A = \pi r^2$$

Area enclosed by a circle of radius r.

Math 10-21 Trapezoid Area

$$A = \frac{a + b}{2} \cdot h$$

Area of a trapezoid as the average of its two parallel sides times the perpendicular height.

Math 10-22 Parallelogram Area

$$A = b \cdot h$$

Area of a parallelogram from its base and perpendicular height.

Math 10-23 Rectangle Perimeter

$$P = 2(l + w)$$

Perimeter of a rectangle from its length and width.

Math 10-24 Square Perimeter

$$P = 4s$$

Perimeter of a square as four times its side length.

Math 10-25 Parallelogram Perimeter

$$P = 2(a + b)$$

Perimeter of a parallelogram from its two side lengths.

Math 10-26 Triangle Perimeter

$$P = a + b + c$$

Perimeter of a triangle as the sum of its three sides.

Math 10-27 Circumference of a Circle

$$C = 2\pi r$$

Distance around a circle of radius r.

Math 10-28 Ellipse Perimeter (Ramanujan Approximation)

$$P \approx \pi \left[3(a + b) - \sqrt{(3a + b)(a + 3b)} \right]$$

Perimeter of an ellipse by Ramanujan's second approximation — accurate to better than one part in a...

Math 10-29 Circular Sector Area

$$A = \frac{1}{2}r^2\theta$$

Area of a pie-slice sector of a circle from its radius and central angle in radians.

Math 10-30 Arc Length

$$s = r\theta$$

Length of a circular arc as radius times central angle in radians.

MODULE 4 · VOLUME & SURFACE AREA

Math 10-31 Rectangular Prism Volume

$$V = l \cdot w \cdot h$$

Volume of a box as the product of its length, width, and height.

Math 10-32 Cube Volume

$$V = a^3$$

Volume of a cube as its edge length raised to the third power.

Math 10-33 Triangular Prism Volume

$$V = \frac{1}{2}bh_tL$$

Volume of a triangular prism — the triangular end area times the prism length, from the triangle's...

Math 10-34 Prism Volume (General Cross-Section)

$$V = BL$$

Volume of any prism or extrusion whose cross-section does not change along its length...

Math 10-35 Cylinder Volume

$$V = \pi r^2 h$$

Volume of a right circular cylinder from its radius and height, using $\pi \approx 3.14159265$.

Math 10-36 Cone Volume $V = \frac{1}{3}\pi r^2 h$ Volume of a right circular cone — one-third of the matching cylinder — using $\pi \approx 3.14159265$.	Math 10-37 Pyramid Volume $V = \frac{1}{3}Bh$ Volume of any pyramid as one-third of its base area times its perpendicular height.	Math 10-38 Sphere Volume $V = \frac{4}{3}\pi r^3$ Volume enclosed by a sphere of radius r , using $\pi \approx 3.14159265$.	Math 10-39 Sphere Surface Area $S = 4\pi r^2$ Surface area of a sphere of radius r , using $\pi \approx 3.14159265$.	Math 10-40 Rectangular Prism Surface Area $A = 2(lw + lh + wh)$ Total surface area of a box — three pairs of matching rectangular faces, from length, width and...
Math 10-41 Cube Surface Area $S = 6a^2$ Surface area of a cube as six times the area of one square face.	Math 10-42 Cylinder Surface Area $S = 2\pi r^2 + 2\pi rh$ Total surface area of a closed cylinder — two end caps plus the wrapped side — using $\pi \approx 3.14159265$.	Math 10-43 Cylinder Lateral Surface Area $A = 2\pi rh$ Area of a cylinder's curved wall only, with no end caps — the label on a can, the insulation around...	Math 10-44 Cone Lateral Surface Area $A = \pi rl$ Curved surface of a right circular cone from its base radius and slant height, excluding the base...	Math 10-45 Cone Slant Height $l = \sqrt{r^2 + h^2}$ Slant height of a right circular cone by Pythagoras on its axial cross-section, from base radius...
Math 10-46 Hemisphere Volume $V = \frac{2}{3}\pi r^3$ Volume of half a sphere, exactly half of the full sphere's $(\frac{4}{3})\pi r^3$.	Math 10-47 Hemisphere Total Surface Area $A = 3\pi r^2$ Total surface of a solid hemisphere: the curved half-sphere $2\pi r^2$ plus the flat circular base...			

MODULE 5 · RIGHT-TRIANGLE TRIGONOMETRY

Math 10-48 Right-Triangle Sine Ratio (SOH) $\sin \theta = \frac{o}{h}$ Relates an acute angle of a right triangle to its opposite side and the hypotenuse.	Math 10-49 Right-Triangle Cosine Ratio (CAH) $\cos \theta = \frac{a}{h}$ Relates an acute angle of a right triangle to its adjacent side and the hypotenuse.	Math 10-50 Right-Triangle Tangent Ratio (TOA) $\tan \theta = \frac{o}{a}$ Relates an acute angle of a right triangle to the ratio of its opposite and adjacent legs.	Math 10-51 Percent Grade from Rise and Run $G = \frac{100 \Delta h}{L}$ Percent grade is one hundred times the vertical rise divided by the horizontal run, measured level,...
Math 10-52 Grade to Slope Angle $\theta = \arctan\left(\frac{G}{100}\right)$ Converts a percent grade into the slope angle measured from horizontal, and back again with the...	Math 10-53 Slope Ratio (H:V) to Percent Grade $G = \frac{100}{n}$ Converts an embankment slope quoted as n horizontal to one vertical into the equivalent percent...		

MODULE 6 · MONEY & INTEREST

Math 10-54 Simple Interest $I = P r t$ Interest earned on a principal at a flat rate per period, without compounding.	Math 10-55 Compound Interest (Periodic) $A = P \left(1 + \frac{r}{n}\right)^{nt}$ Amount after t periods when interest compounds n times per period at rate r .	Math 10-56 Effective Annual Rate from a Nominal Rate $EAR = \left(1 + \frac{r}{m}\right)^m - 1$ What a quoted nominal annual rate really costs or earns once it compounds m times a year — 12%...
Math 10-57 Rule of 72 (Doubling Time) $n \approx \frac{0.72}{i}$ Mental-arithmetic estimate of how many periods it takes money to double at rate i — with the rate...	Math 10-58 Present Value $PV = \frac{FV}{(1 + r)^t}$ Today's value of a future amount, discounted at rate r per period.	