FACTS EVERY GOOD MATHLETE SHOULD KNOW

1.) Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

2.) Solving $ax^2 + bx + c = 0$

$b^2 - 4ac < 0 \Rightarrow$ no real roots
$b^2 - 4ac = 0 \Rightarrow$ one double root
$b^2 - 4ac > 0 \Rightarrow$ two real roots

Sum of roots is $-\dfrac{b}{a}$ Product of roots is $\dfrac{c}{a}$ Average of roots is $-\dfrac{b}{2a}$

3.) First coordinate of vertex of parabola $Y = ax^2 + bx + c$ is $\dfrac{-b}{2a}$

4.) A.) $\log_A C = T \Leftrightarrow A^T = C$

B.) $\log_A C = \dfrac{1}{\log_C A}$

C.) $\log (A \bullet B) = \log A + \log B$

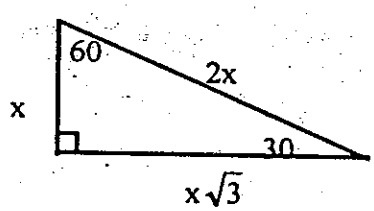
D.) $\log \left(\dfrac{A}{B}\right) = \log A - \log B$

E.) $\log A^B = B (\log A)$

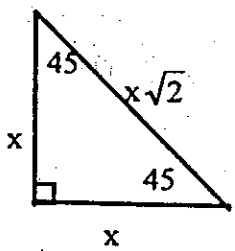
F.) $\log \sqrt[B]{A^C} = \log A^{\frac{C}{B}} = \dfrac{C}{B} (\log A)$

G.) $\log_a b = \dfrac{\log_C b}{\log_C a}$

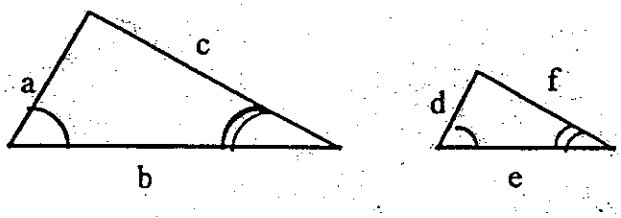
5.) 30° - 60° - right triangle



45° - 45° - right triangle



6.) Similar triangles: $\frac{a}{d} = \frac{b}{e} = \frac{c}{f}$



7.) Slope: $m = \frac{Y_2 - Y_1}{X_2 - X_1}$

Slope of $Y = mx + b$ is m and Y-intercept is b

Slope of $AX + BY = C$ is $-\frac{A}{B}$ and Y-intercept is $\frac{C}{B}$

Slopes of parallel lines are equal if slopes are defined

Slopes of perpendicular lines are negative reciprocals if slopes defined

Slope of a vertical line is undefined

8.) Arithmetic progression or sequence: Any two terms have same difference

$$T_1;\ T_1 + d;\ T_1 + 2d;\ T_1 + 3d;\ T_1 + 4d;\ \ldots$$

any term: $T_n = T_1 + (n - 1)d$

Sum of n terms: $S_n = \frac{n}{2}[T_1 + T_n]$ or $S_n = \frac{n}{2}[2T_1 + (n - 1)d]$

9.) Geometric progression or sequence: Any two terms have same ratio

$$T_1;\ T_1r;\ T_1r^2;\ T_1r^3;\ T_1r^4;\ \ldots$$

Any term: $T_n = T_1 \bullet r^{n-1}$

Sum of n terms: $S_n = \frac{T_1(1 - r^n)}{1 - r}$ OR $S_n = \frac{T_1 - r \bullet T_n}{1 - r}$

Sum of **infinite** G.P.: $S = \frac{T_1}{1 - r}$ if $|r| < 1$

10.) Arithmetic mean of a and b is $\frac{a + b}{2}$

Geometric mean of a and b is $\sqrt{a \bullet b}$

11.) Number written in base r

$1\,2\,3\,4\,5_r \Rightarrow 1 \bullet r^4 + 2 \bullet r^3 + 3 \bullet r^2 + 4r^1 + 5r^0$

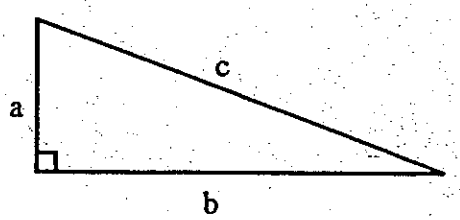
i.e. $1\,2\,3_4 = 1 \bullet 4^2 + 2 \bullet 4^1 + 3 \bullet 4^0 = 16 + 8 + 3 = 27$

12.) Know method for changing **repeating decimal** to a **fraction**

$.9\overline{191}$

$$\begin{aligned} 100\,N &= 91.9\overline{191} \\ N &= \quad .9\overline{191} \\ \hline 99\,N &= 91 \\ N &= \frac{91}{99} \end{aligned}$$

13.) Pythagorean Theorem $a^2 + b^2 = c^2$



Also midpoint of hypotenuse is equidistant from all three vertices

14.) Area:

Equilateral Δ: $A = \frac{s^2}{4}\sqrt{3}$

Regular Polygon: $A = \frac{1}{2}a \bullet p$

Trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$

a = apothem

p = perimeter

Rhombus: $A = \frac{1}{2}d_1 \bullet d_2$

Circle: $A = \pi r^2$

Sphere: $A = 4\,\pi r^2$

Cone: $A = \pi r^2 + 2\,\pi r\,\ell$ (ℓ is slant height)

Cylinder: $A = 2\,\pi r^2 + 2\,\pi rh$

15.) Volume : Prism : $V = Bh$ B = Area of base

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

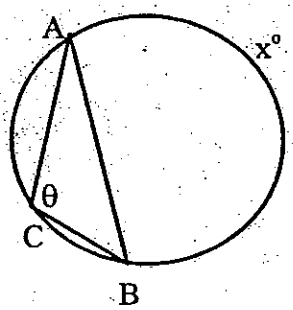
Pyramid : $V = \frac{1}{3} B \bullet h$

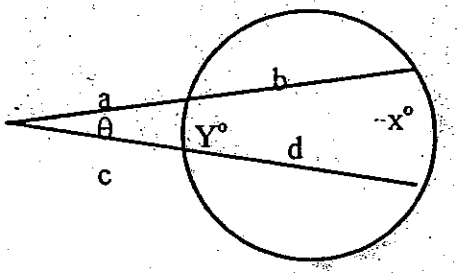
Cone : $V = \frac{1}{3} \pi r^2 h$

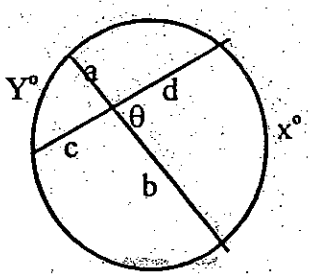
Sphere : $V = \frac{4}{3} \pi r^3$

Cube : $V = e^3$

16.) Circles







$\theta = \frac{1}{2} x$

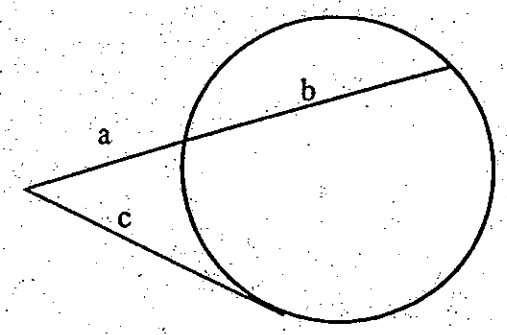
$\theta = \frac{1}{2}(X - Y)$

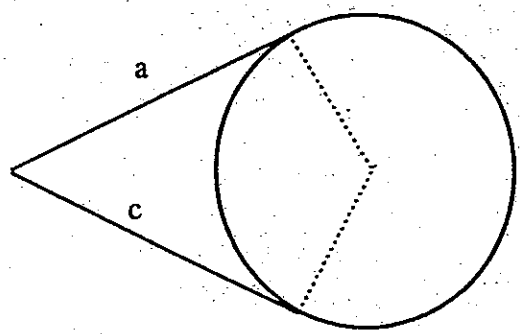
$\theta = \frac{1}{2}(X + Y)$

$\theta = 90°$ if $\overline{AB}$ is diameter

$a(a + b) = c(c + d)$

$a \bullet b = c \bullet d$

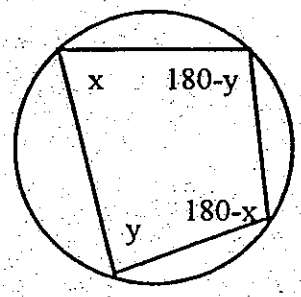




$a(a + b) = c^2$

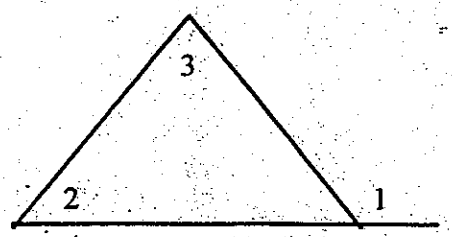
$a = c$

radius $\perp$ tangent



Opposite angles of inscribed quadrilateral are supplementary

17.)



$\angle 1 = \angle 2 + \angle 3$

Exterior angle = Sum of remote interior angles

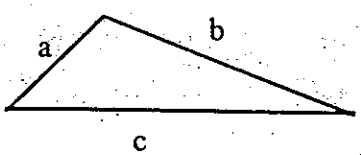
18.) Sum of interior angles of an n - gon is $180(n - 2)$

Sum of exterior angles of an n - gon is $360°$

Each interior angle of a **regular** n - gon is $\frac{180(n-2)}{n}$

Each exterior angle of a **regular** n - gon is $\frac{360}{n}$

19.)



1.) Sum of any 2 sides of triangle is greater than 3rd side

2.) $|a - b| < c < a + b$

20.) A median is segment from vertex of triangle drawn to midpoint of opposite side

21.) Factoring:

$x^2 - y^2 = (x - y)(x + y)$

$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$

$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

$x^2 + y^2$ is prime

22.) The area of a convex n - gon with vertices (x_1, y_1), (x_2, y_2), (x_3, y_3) . . . (x_n, y_n) is

$$A = \frac{1}{2}\left| \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix} + \begin{vmatrix} x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} + \begin{vmatrix} x_3 & y_3 \\ x_4 & y_4 \end{vmatrix} + \ldots + \begin{vmatrix} x_n & y_n \\ x_1 & y_1 \end{vmatrix} \right|$$

Absolute value symbol

Determinant symbol

23.) In similar polygons: $\frac{A_1}{A_2} = (\frac{S_1}{S_2})^2$

In similar solids: $\frac{V_1}{V_2} = (\frac{S_1}{S_2})^3$

24.) The numbers 1 and 51 are not prime!

25.) If $X^Y = 1$, then $X \neq 0$ and $Y = 0$ or $X = 1$ and $Y = R$ or $X = -1$ and $Y =$ even integer

26.) The number of permutations of n different objects is n! That is ${}_nP_n = n!$

27.) The number of permutations of r objects selected from n different objects is $\frac{n!}{(n-r)!}$; that is

${}_nP_r = \frac{n!}{(n-r)!}$

28.) The number of permutations of n objects, not all different, a of one type, b of another type, c of a 3rd type, etc. is $\frac{n!}{a!b!c!\ldots}$

29.) The number of combinations of r objects selected from n different objects is $\frac{n!}{(n-r)!r!}$; that is

${}_nC_r = \frac{n!}{(n-r)!r!}$

30.) Know difference between mean, median, and mode.

31.) $\cos(a \pm B) = \cos a \cos B \pm \sin a \sin B$

$\sin(a \pm B) = \sin a \cos B \pm \cos a \sin B$