

## Topic 1: Number &amp; Algebra

Topic 1: Number & Algebra		Topic 3: Geometry & Trigonometry		Topic 4: Statistics & Probability	
1.2	$u_n = u_1 + (n-1)d$ Sum of $n$ terms of an arithmetic sequence $S_n = \frac{n}{2}(2u_1 + (n-1)d) = \frac{n}{2}(u_1 + u_n)$	Distance between 2 points $(x_1, y_1, z_1); (x_2, y_2, z_2)$ Coordinates of midpoint of $(x_1, y_1, z_1); (x_2, y_2, z_2)$ Volume: right-pyramid Volume: right-cone Surface area: cone curve Volume: sphere Surface area: sphere	$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$ $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}, \frac{z_1+z_2}{2}\right)$ $V = \frac{1}{3}Ah$ , where $A$ is area of base, $h$ is height $V = \frac{1}{3}\pi r^2 h$ , where $r$ is radius, $h$ is height $A = \pi r l$ , where $r$ is radius, $l$ is slant height $V = \frac{4}{3}\pi r^3$ , where $r$ is the radius $A = 4\pi r^2$ , where $r$ is the radius	4.14 Variance $\sigma^2$ Standard deviation $\sigma$ Linear transformation: single random variable Expected value of a continuous random variable $X$ Variance Variance of a discrete random variable $X$ Variance of a continuous random variable $X$	$\sigma^2 = \frac{\sum_{i=1}^k f_i(x_i - \mu)^2}{n} = \frac{\sum_{i=1}^k f_i x_i^2}{n} - \mu^2$ $\sigma = \sqrt{\frac{\sum_{i=1}^k f_i(x_i - \mu)^2}{n}}$ $E(ax + b) = aE(X) + b$ $\text{Var}(ax + b) = a^2 \text{Var}(X)$ $E(X) = \mu = \int_{-\infty}^{\infty} xf(x)dx$ $\text{Var}(X) = E[(X - \mu)^2] = E(X^2) - [E(X)]^2$ $\text{Var}(X) = \sum (X - \mu)^2 P(X = x) = \sum x^2 P(X = x) - \mu^2$ $\text{Var}(X) = \int_{-\infty}^{\infty} (X - \mu)^2 f(x)dx = \int_{-\infty}^{\infty} x^2 f(x)dx - \mu^2$
1.3	$u_n = u_1 r^{n-1}$ Sum of $n$ terms of a finite geometric sequence $S_n = \frac{u_1(r^n - 1)}{r - 1} = \frac{u_1(1 - r^n)}{1 - r}$ , $r \neq 1$	1.8 The sum of an infinite geometric sequence $S_{\infty} = \frac{u_1}{1 - r}$ , $ r  < 1$	3.2 Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ Cosine rule $c^2 = a^2 + b^2 - 2ab \cos C$ $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$ Area of a triangle $A = \frac{1}{2}ab \sin C$	3.4 Length of an arc $l = r\theta$ Area of a sector $A = \frac{1}{2}r^2\theta$	where $r$ is the radius, $\theta$ is the angle measured in radians
1.4	Compound Interest $FV = PV \times \left(1 + \frac{r}{100k}\right)^n$ $FV$ is future value, $PV$ is present value, $n$ is number of years, $k$ is compounding periods per year, $r\%$ is nominal annual interest rate	1.5 Exponents and logarithms $a^x = b \Leftrightarrow x = \log_a b$ , $a, b > 0, a \neq 1$	3.5 Identity for $\tan \theta$ $\tan \theta = \frac{\sin \theta}{\cos \theta}$	3.6 Pythagorean identity $\cos^2 \theta + \sin^2 \theta = 1$ Double angle identities $\sin 2\theta = 2 \sin \theta \cos \theta$ $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$ $= 2\cos^2 \theta - 1$ $= 1 - 2\sin^2 \theta$	3.9 Reciprocal trig identities $\sec \theta = \frac{1}{\cos \theta}$ ; $\cosec \theta = \frac{1}{\sin \theta}$ Pythagorean identities $1 + \tan^2 \theta = \sec^2 \theta$ ; $1 + \cot^2 \theta = \cosec^2 \theta$
1.7	Exponents and logarithms $\log_a xy = \log_a x + \log_a y$ $\log_a \frac{x}{y} = \log_a x - \log_a y$ $\log_a x^m = m \log_a x$ $\log_a \frac{x}{y} = \frac{\log_a x}{\log_a y}$	Exponential and logarithmic functions $a^x = e^{x \ln a}$ ; $\log_a x^y = x = a^{\log_a x}$ where $a, x > 0, a \neq 1$	3.10 Compound angle identities $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$ $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$	3.11 Double angle identity for tan $\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$	3.12 Magnitude of vector $ \mathbf{v}  = \sqrt{v_1^2 + v_2^2 + v_3^2}$
1.9	Binomial theorem, $n \in \mathbb{N}$ $(a+b)^n = a^n + {}^n C_1 a^{n-1} b + \dots + {}^n C_r a^{n-r} b^r + \dots + b^n$ ${}^n C_r = \frac{n!}{r!(n-r)!}$	1.10 Combinations ${}^n C_r = \frac{n!}{r!(n-r)!}$	3.13 Scalar product $\mathbf{v} \cdot \mathbf{w} = v_1 w_1 + v_2 w_2 + v_3 w_3$ $\mathbf{v} \cdot \mathbf{w} =  \mathbf{v}  \mathbf{w}  \cos \theta$ where $\theta$ is angle between $\mathbf{v}$ and $\mathbf{w}$	3.14 Angle between two vectors $\cos \theta = \frac{v_1 w_1 + v_2 w_2 + v_3 w_3}{ \mathbf{v}  \mathbf{w} }$	3.15 Area: parallelogram $A =  \mathbf{v} \times \mathbf{w} $ , where $\mathbf{v}$ and $\mathbf{w}$ form 2 adjacent sides of parallelogram
1.11	Permutations ${}^n P_r = \frac{n!}{(n-r)!}$	1.12 Extension of the binomial theorem, $n \in \mathbb{Q}$ $(a+b)^n = a^n \left(1 + n \left(\frac{b}{a}\right) + \frac{n(n-1)}{2!} \left(\frac{b}{a}\right)^2 + \dots\right)$	3.16 Vector product $\mathbf{v} \times \mathbf{w} = \begin{pmatrix} v_2 w_3 - v_3 w_2 \\ v_3 w_1 - v_1 w_3 \\ v_1 w_2 - v_2 w_1 \end{pmatrix}$	3.17   $\mathbf{v} \times \mathbf{w}$   = $ \mathbf{v}  \mathbf{w}  \sin \theta$ where $\theta$ is angle between $\mathbf{v}$ and $\mathbf{w}$	3.18 3.19 3.20 3.21 3.22 3.23 3.24 3.25 3.26 3.27 3.28 3.29 3.30 3.31 3.32 3.33 3.34 3.35 3.36 3.37 3.38 3.39 3.40 3.41 3.42 3.43 3.44 3.45 3.46 3.47 3.48 3.49 3.50 3.51 3.52 3.53 3.54 3.55 3.56 3.57 3.58 3.59 3.60 3.61 3.62 3.63 3.64 3.65 3.66 3.67 3.68 3.69 3.70 3.71 3.72 3.73 3.74 3.75 3.76 3.77 3.78 3.79 3.80 3.81 3.82 3.83 3.84 3.85 3.86 3.87 3.88 3.89 3.90 3.91 3.92 3.93 3.94 3.95 3.96 3.97 3.98 3.99 3.100 3.101 3.102 3.103 3.104 3.105 3.106 3.107 3.108 3.109 3.110 3.111 3.112 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