Formula Sheet

TI PROFESSIONAL DEVELOPMENT

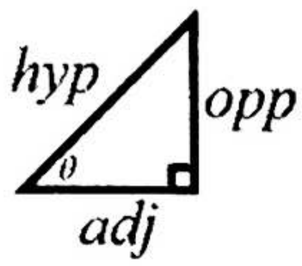
Formula Favorites – *These types are used at least once per test.*

SohCahToa

$\sin(\theta) = \frac{opp}{hyp}$

$\cos(\theta) = \frac{adj}{hyp}$

$\tan(\theta) = \frac{opp}{adj}$



Slope

$m \perp =$ opposite reciprocal

$m \| =$ same

$m = 0$

$m = undefined$

Slope-Intercept form

$y = m \cdot x + b$

slope, y-int

Slope Formula

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

Standard Form

$ax + by = c$

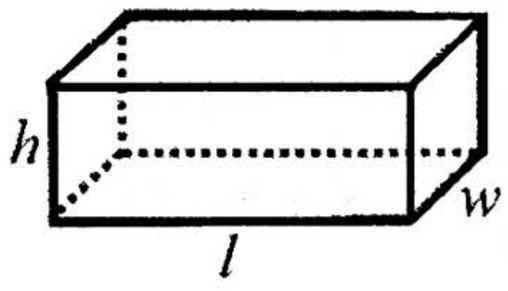
$m = \frac{-a}{b}$

Rectangles

$perimeter = 2w + 2l$

$Area = l \cdot w$

$Volume = l \cdot w \cdot h$



Mean (average)

1. Add up the terms
2. Divide by the # of terms

Median

1. Order the terms
2. Find the middle term

Mode

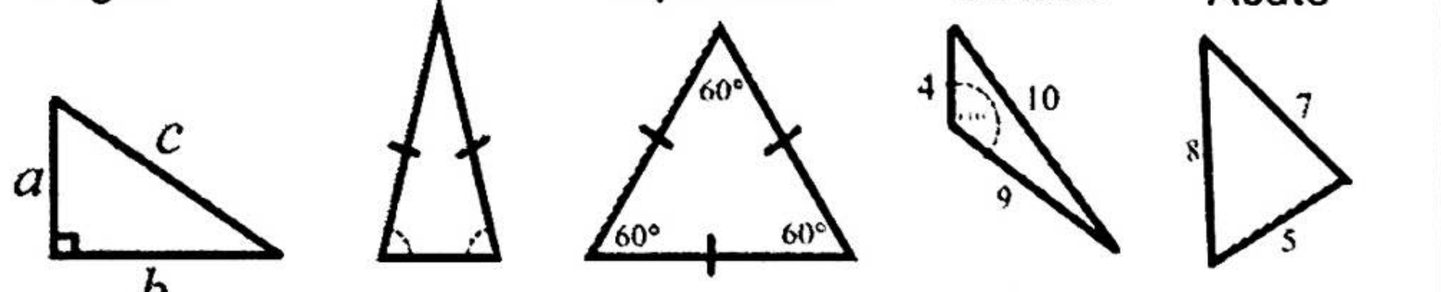
1. Most common term

Exponent Rules

1. $x^2 \cdot x^3 = x^{2+3}$
2. $\left(x^2\right)^3 = x^{2 \cdot 3}$
3. $\frac{x^7}{x^4} = x^{7-4}$
4. $x^0 = 1, x \neq 0$
5. $x^{-2} = \frac{1}{x^2}$
6. $\left(x\right)^{2/3} = \sqrt[3]{x^2}$

Triangles

Right | Isosceles | Equilateral | Scalene Obtuse | Scalene Acute



Pythagorean Th.

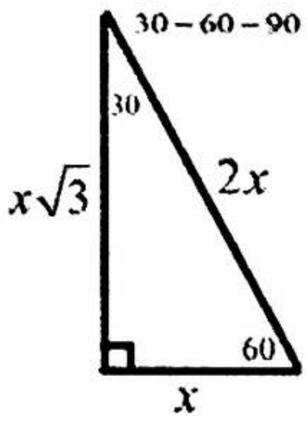
$a^2 + b^2 = c^2$

Obtuse $a^2 + b^2 < c^2$ $4^2 + 9^2 < 10^2$

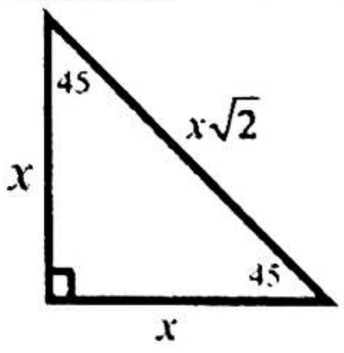
Acute $a^2 + b^2 > c^2$ $5^2 + 7^2 > 8^2$

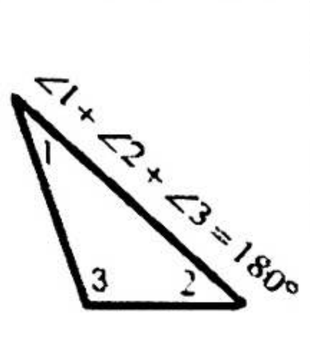
Special Triangles

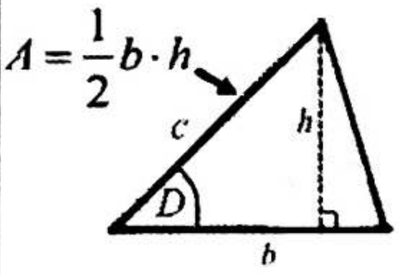
30 − 60 − 90 &



45 − 45 − 90



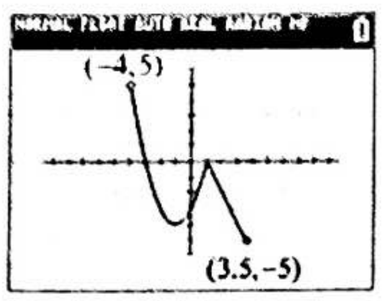




SAS Area formula

$A = \frac{1}{2} \cdot b \cdot c \cdot \sin(D)$

Domain($x-values$) & Range($y-values$)

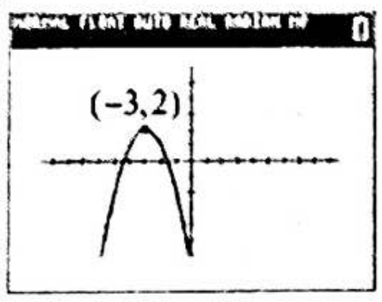


$domain: -4 < x \leq 3.5$

$range: -5 \leq y < 5$

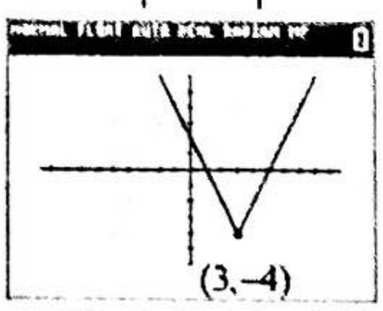
Transformations

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



reflect through x-axis, shift left 3, shift up 2

$y = 2|x-3| - 4$



vertical stretch, shift right 3, shift down 4

If (x, y) maps to (kx, ky) and $(2,5)$ maps to $(8,20)$. Then, $(3,7)$ maps to ?

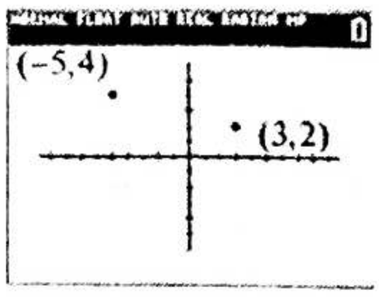
answer: $(12,28)$

Formula Sheet

TI PROFESSIONAL DEVELOPMENT

Somewhat Common Formulas – *These types are seen on over half of the tests.*

Distance



Distance Formula

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

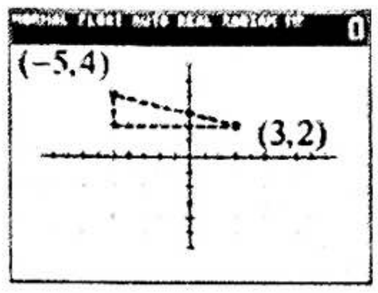
$d = \sqrt{(3-(-5))^2 + (2-4)^2}$

$d = \sqrt{64+4}$

$d = \sqrt{68}$

$d = 2\sqrt{17}$

or



Pythagorean Th.

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

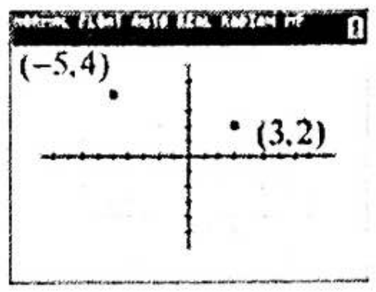
$8^2 + 2^2 = d^2$

$68 = d^2$

$d = \sqrt{68}$

$d = 2\sqrt{17}$

Midpoint



Midpoint Formula

$(x,y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$= \left(\frac{-5+3}{2}, \frac{4+2}{2}\right)$

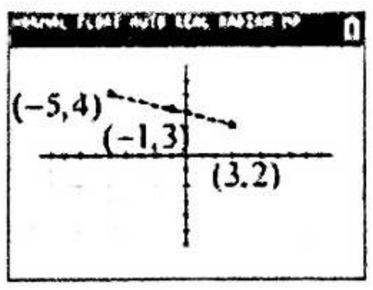
$= (-1,3)$

Midpoint is just the (*average* x, *average* y)

See the linear pattern?

$x: -5, -1, 3$

$y: 4, 3, 2$



Imaginary Numbers

$i = \sqrt{-1}$ and $i^2 = -1$

Simplify $(x+i)^2$

$(x+i)(x+i)$

$x^2 + xi + xi + i^2$

$x^2 + 2xi - 1$

Powers of i

$i^1 = i^5 = i^9 = i$

$i^2 = i^6 = i^{10} = -1$

$i^3 = i^7 = i^{11} = -i$

$i^4 = i^8 = i^{12} = 1$

$i^{\text{multiple of 4}} = 1$

Example: $i^{27} = (i^{24})(i^3)$

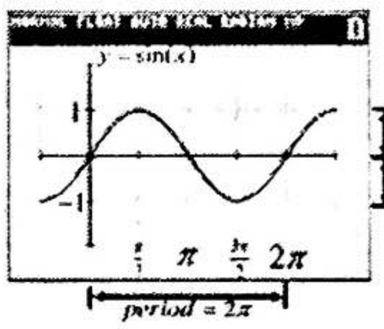
$= (1)(-i) = -i$

Trigonometry

$y = a \cdot \sin(b(x-c)) + d$

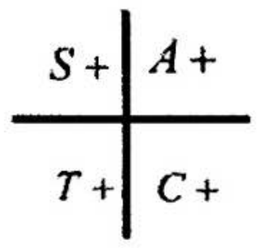
amplitude

$period = \frac{2\pi}{|b|}$

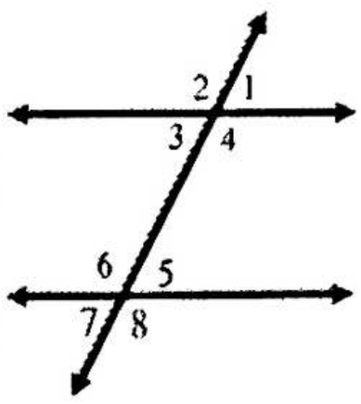


$\sin^2(x) + \cos^2(x) = 1$

$180° = \pi$ *radians*



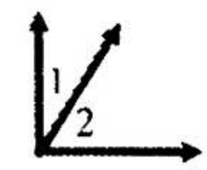
Angles



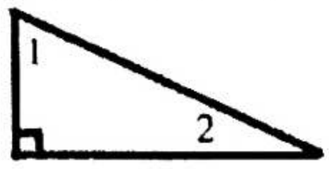
Parallel Lines cut by a Transversal

- **Alternate Interior**
  $\angle 3 \cong \angle 5$ and $\angle 4 \cong \angle 6$
- **Same Side Interior**
  $\angle 4 + \angle 5 = 180°$ and $\angle 3 + \angle 6 = 180°$
- **Alternate Exterior**
  $\angle 2 \cong \angle 8$ and $\angle 1 \cong \angle 7$
- **Corresponding**
  $\angle 4 \cong \angle 8$ and $\angle 3 \cong \angle 7$

Complementary Angles add to 90°

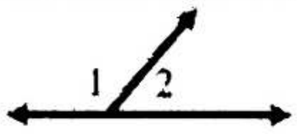


$\angle 1 + \angle 2 = 90°$



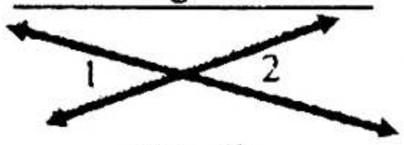
$\angle 1 + \angle 2 = 90°$

Supplementary Angles add to 180°



$\angle 1 + \angle 2 = 180°$

Vertical angles are congruent



$\angle 1 \cong \angle 2$

Logarithm Rules

Log form $\log_3(9) = x$

Exponential form $3^x = 9$

1. $\log_5(2) + \log_5(3) = \log_5(2 \cdot 3)$
2. $\log_5(2^3) = 3 \cdot \log_5(2)$
3. $\log_5\left(\frac{2}{3}\right) = \log_5(2) - \log_5(3)$
4. $\log_5(1) = 0$
5. $\log_5(5) = 1$
6. $\log_5(5^3) = 3$
7. $5^{\log_5(3)} = 3$

Formula Sheet

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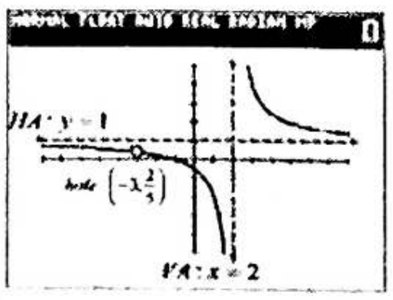
Less Common Formulas – *These types are seen on about 1 in every 2 or 3 tests.*

Asymptotes



$$y = \frac{(x+1)(x+3)}{(x-2)(x+3)}$$

Vertical Asymptote (VA)

To find VA, set the denominator = zero and solve for x

Hole

If a factor cancels, it causes a hole instead of a VA

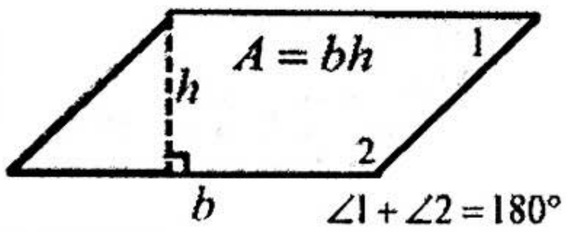
Horizontal Asymptote (HA)

1. If *bottomheavy* degree, then HA at $y = 0$
2. If *topheavy* degree, then there is no HA
3. If *same* degree then divide the leading coefficients

Slant Asymptote

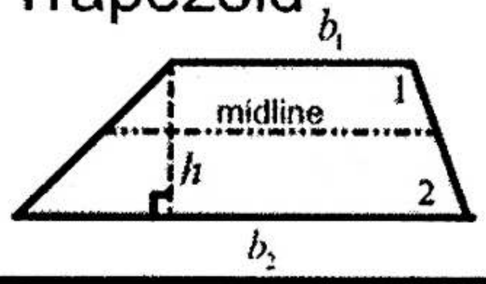
If the degree in the numerator is one more than the denominator, use long division to find the slant asymptote

Parallelogram



$\angle 1 + \angle 2 = 180°$

Trapezoid

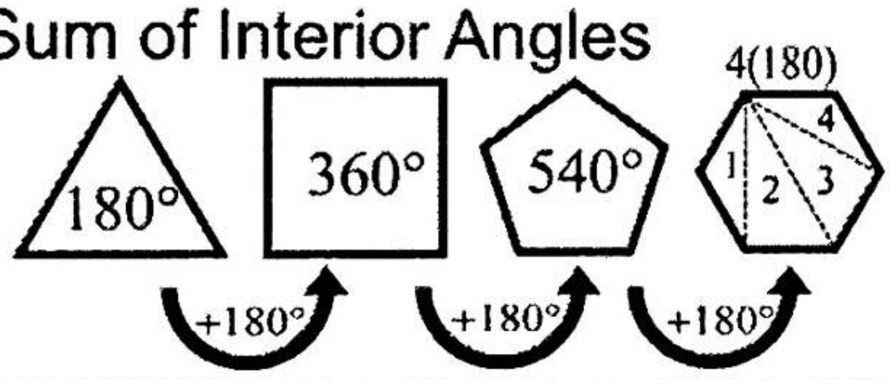


$$Area = \frac{1}{2}(b_1 + b_2) \cdot h = (\text{avg. base}) \cdot h$$

$$midline = \frac{b_1 + b_2}{2} = (\text{avg. base})$$

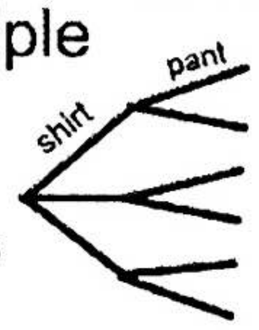
$\angle 1 + \angle 2 = 180°$

Sum of Interior Angles



Counting Principle

Jamie has 3 shirts and 2 pairs of pants.
How many different outfits can Jamie wear?



Draw a tree diagram or use the *counting principle*: (3)(2)=6

Matrices

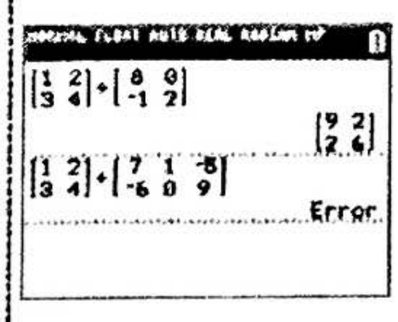
Dimensions
row × column

3×2

$$\begin{bmatrix} 1 & 8 \\ -2 & 0 \\ 3 & 5 \end{bmatrix}$$

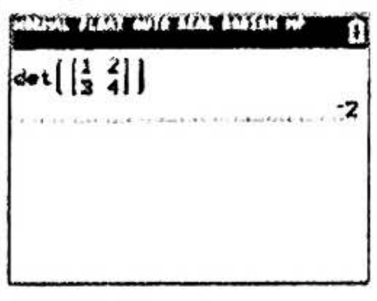
Adding Matrices

- must have the same dimensions



Determinants

$$\det\begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - cb$$



Multiplying Matrices

- *inner* dimensions must match

3×2 $\quad$ 2×4 — Yes!

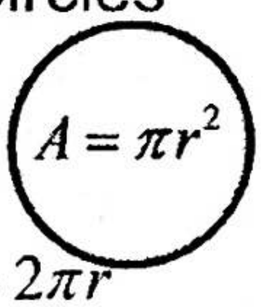
2×4 $\quad$ 3×2 — No! (not possible)

Augmented Matrices

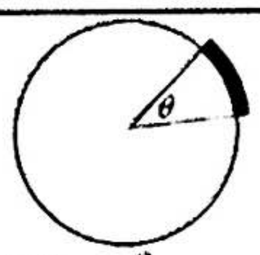
$$\begin{aligned} 2x - 3y &= 10 \\ -x + 8y &= -5 \end{aligned}$$

$$\left[\begin{array}{cc|c} 2 & -3 & 10 \\ -1 & 8 & -5 \end{array}\right]$$

Circles



$c = 2\pi r$



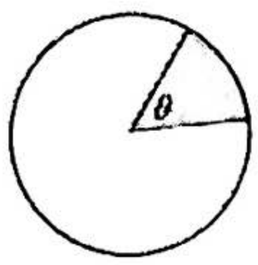
$$\text{length arc} = \frac{\theta}{360}(circ.)$$

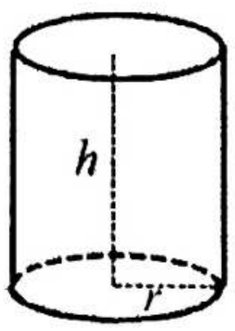
$c = 2\pi r$

$$(x-h)^2 + (y-k)^2 = r^2$$

$$\text{area sector} = \frac{\theta}{360}(area)$$

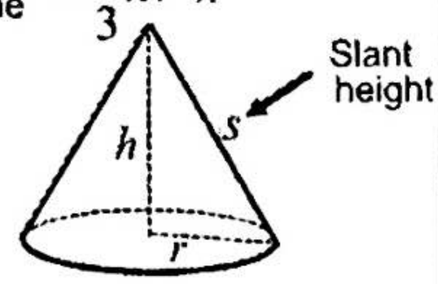
$A = \pi r^2$





$$\text{Volume Cylinder} = \pi r^2 \cdot h$$

$$\text{Volume Cone} = \frac{1}{3}\pi r^2 h$$



$$\text{Surface Area Cone} = \pi r^2 + \pi r \cdot s$$

Formula Sheet

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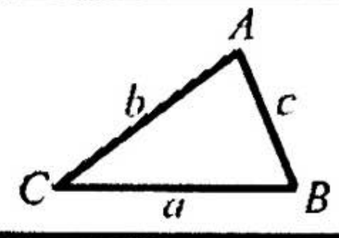
Uncommon Formulas – *These types are seen on about 1 in every 4 tests.*

Law of Sines

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$



Law of Cosines

$$c^2 = a^2 + b^2 - 2ab \cdot \cos(C)$$

Difference of Cubes

$$a^3 - b^3 = (a-b)\left(a^2 + ab + b^2\right)$$

Sum of Cubes

$$a^3 + b^3 = (a+b)\left(a^2 - ab + b^2\right)$$

Compound Interest

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

Discriminant

discriminant $= b^2 - 4ac$

1. If $b^2 - 4ac > 0$, then 2 real solutions
2. If $b^2 - 4ac < 0$, then no real solutions
3. If $b^2 - 4ac = 0$, then 1 real solution

Triangle Inequality Theorem

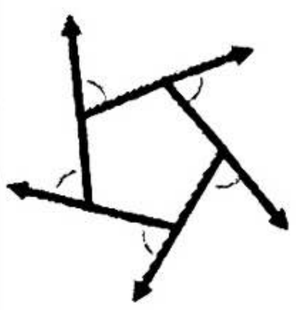
The sum of the lengths of any two sides of a triangle is greater than the length of the third side

A. 2,5,8 — NO, $2 + 5 < 8$

B. 4,5,6 — YES

C. 5,7,12 — NO, $5 + 7 = 12$

Sum of Exterior Angles



The sum of the exterior angles of any polygon is always $360°$

Expected Value (on average)

What is the expected value for the sum of 2 dice rolls?

sum of 2 dice (x)	2	3	4	5	6	7	8	9	10	11	12
P(x)	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

Expected Value $= p_1x_1 + p_2x_2 + p_3x_3 + \ldots$

answer=7

Standard Deviation

Typical distance from the mean

Example: Which list has a larger standard deviation?

$A: \{1,3,5,7,9,11\}$

$B: \{2,2,2,10,10,10\}$

Answer: B, mean=6 for both, but list B is more spread out

Permutations & Combinations

(order matters) (order doesn't matter)

Example: There are 5 runners in a race.

a. How many ways can you give out a gold, silver, and bronze medal? *answer:* ${}_nP_r(5,3)$

b. How many different combinations of people could have a medal at the end of the race? *answer:* ${}_nC_r(5,3)$

Sequences

Arithmetic Sequences

16 13 10 7 4 ... ($d = -3$)

$$a_n = a_1 + (n-1)d$$

Geometric Sequences

3 -6 12 -24 48 ... ($r = -2$)

$$a_n = a_1 \cdot (r)^{n-1}$$

Recursive Sequences

$$a_n = (a_{n-1}) + 5 \text{ where } a_1 = 6$$

(a_{n-1}: Previous Term)

6 11 16 21 26 ...

a_1 a_2 a_3 a_4 a_5

Miscellaneous topics: distance in complex plane, joint variation, multiplicity, tangent lines, simplifying using the conjugate, independent events, polar, vectors, prime numbers.