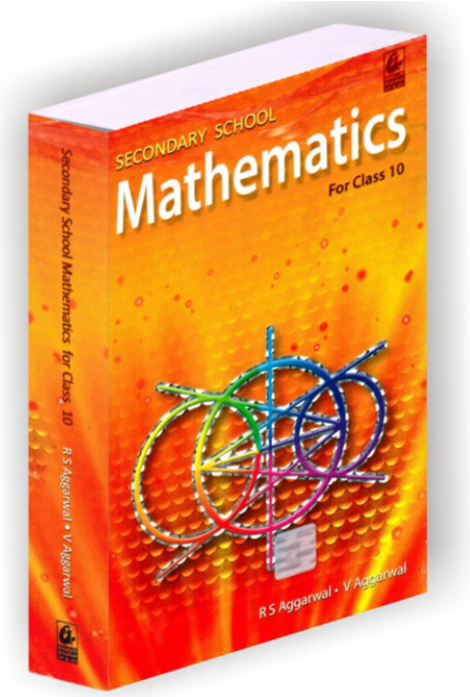
RS Aggarwal Solutions for Class 10 Maths Chapter 5–Arithmetic Progression

Class 10 - Chapter 5 Arithmetic Progressions



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RS Aggarwal Solutions for Class 10 Maths Chapter 5–Arithmetic Progression

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Exercise 5A

Arithmetic Progression

Definition: An ***arithmetic progression*** is a sequence of the form: $a, a+d, a+2d, \ldots, a+nd, \ldots$

where the ***initial term*** a and the ***common difference*** d are real numbers.

Examples:

1. Let $a = -1$ and $d = 4$:

$$\{s_n\} = \{s_0, s_1, s_2, s_3, s_4, \ldots\} = \{-1, 3, 7, 11, 15, \ldots\}$$

2. Let $a = 7$ and $d = -3$:

$$\{t_n\} = \{t_0, t_1, t_2, t_3, t_4, \ldots\} = \{7, 4, 1, -2, -5, \ldots\}$$

3. Let $a = 1$ and d = 2:

$$\{u_n\} = \{u_0, u_1, u_2, u_3, u_4, \ldots\} = \{1, 3, 5, 7, 9, \ldots\}$$

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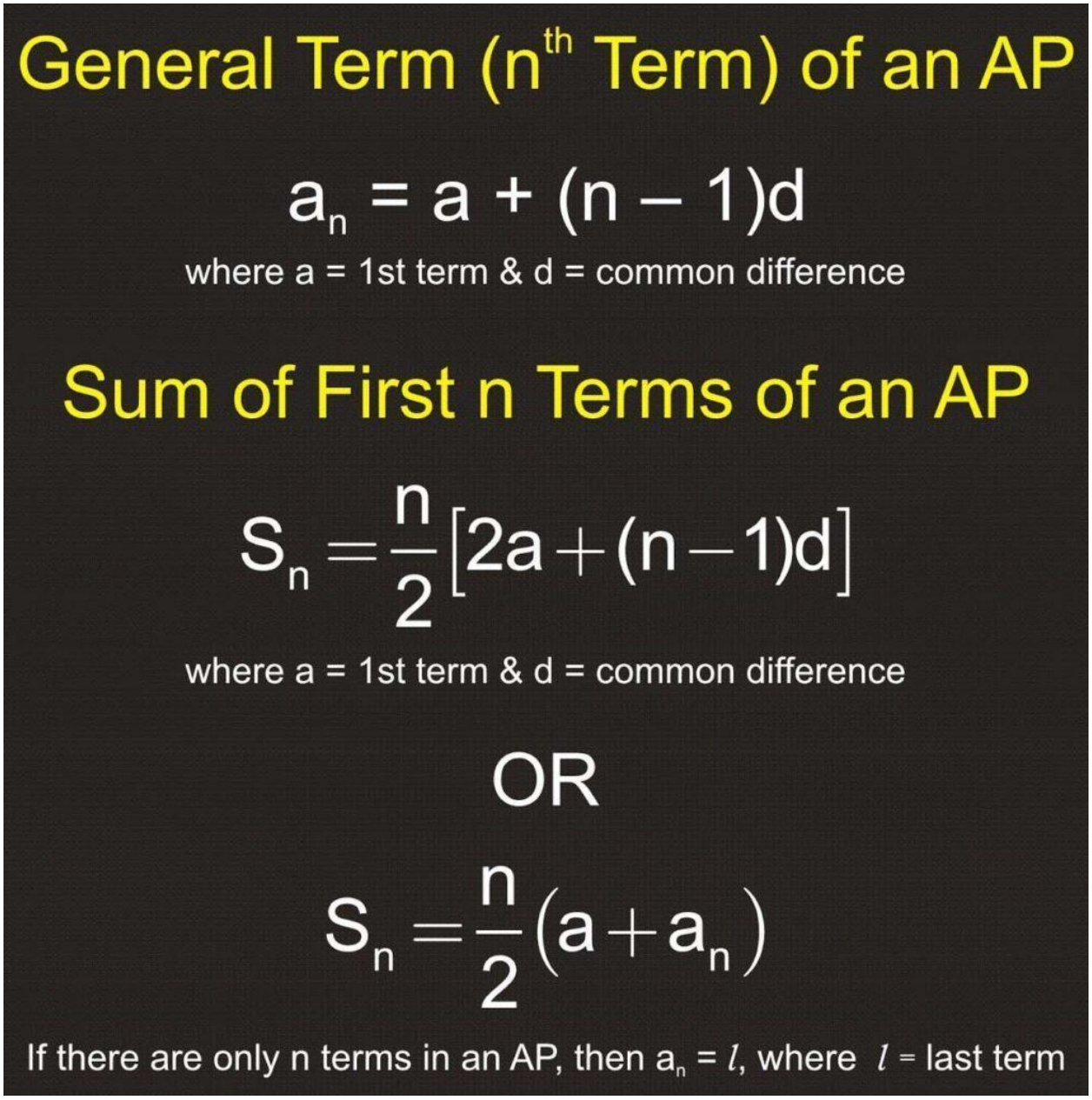

Question 1:

The given progression is 3, 9, 15, 21 …..

Clearly (9 – 3) = (15 – 9) = (21 – 15) = 6 which is constant

Thus, each term differs from its preceding term by 6

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So, the given progression is an AP

Its first term = 3 and the common difference = 6

Question 2:

The given progression is 16, 11, 6, 1, -4 ….

Clearly (11 – 16) = (1 – 6) = (-4 – 1) = – 5 which is constant

Thus, each term differs from its preceding term by – 5

So the given progression is an AP

Its first term = 16 and the common difference = – 5

Question 3:

(i) The given AP is 1, 5, 9, 13, 17…..

Its first term = 1 and common difference = (5 – 1) = 4

∴ a = 1 and d = 4

The n^{th} term of the AP is given by

$T_n = a + (n-1)\, d$

$T_{20} = 1 + (20-1) \times 4 = 1 + 76 = 77$

Hence, the 20^{th} term is 77

(ii) The given AP is 6, 9, 12, 15 ……

Its first term = 6 and common difference = (9 – 6) = 3

∴ a = 6, d = 3

The n^{th} term of the AP is given by

$T_n = a + (n-1)\, d$

$T35 = 6 + (35-1) \times 3 = 6 + 102 = 108$

Hence, the 35^{th} term is 108

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(iii) The given AP is 5, 11, 17, 23 …..

Its first term = 5, and common difference = (11 – 5) = 6

∴ a = 5, d = 6

The n^{th} term of AP is given by

$T_n = a + (n-1) d$

$T_n = 5 + (n-1) \times 6 = 5 + 6n – 6 = 6n – 1$

(iv) The given AP is (5a – x), 6a, (7a + x) …..

Its first term = (5a – x) and common difference = 6a – 5a – x = a + x

The n^{th} term of AP is given by

$T_n = a + (n-1) d$

$T_{11} = (5a – x) + (11-1) (a + x)$

$= 5a – x + 10x + 10x$

$= 15a + 9x = 3(5a + 3x)$

Hence the 11^{th} term is 3(5a + 3x)

Question 4:

(i) The given AP is 63, 58, 53, 48 ….

First term = 63, common difference = 58 – 63 = – 5

∴ a = 63, d = – 5

The n^{th} term of AP is given by

$T_n = a + (n-1) d$

$T_{10} = 63 + (10-1) (-5) = 63 - 45 = 18$

Hence the 10^{th} term is 18

(ii) The given AP is 9, 5, 1, -3….

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First term = 9, common difference = 5 – 9 = -4

∴ a = 9, d= – 4

The n^{th} term of AP is given by

$T_n = a + (n-1)\, d$

$T_{14} = 9 + (14-1)\,(-4) = 9- 52 = -43$

Hence, the 14^{th} term is – 43

(iii) The given AP is 16, 9, 2, -5

First term = 16, common difference = 9 – 16 = – 7

∴ a = 16, d = -7

The n^{th} term of AP is given by

$T_n = a + (n-1)\, d$

$T_n = 16 + (n-1)\,(-7) \Rightarrow 16- 7n + 7 = (23 – 7n)$

Hence, the n^{th} term is (23 – 7n).

Question 5:

The given AP is 6,734,912,1114……..

First term = 6, common difference = (734−6)

= (314−6)

= 74

a = 6, d = 74

The n^{th} term is given by

$T_n = a + (n-1)\, d$

$T_{14} = 6 + (37 – 1)\,(74) = 6+ 63 = 69$

Hence, 37^{th} term is 69

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Question 6:

The given AP is 5,412,4,312,3……..

The first term = 5,

common difference = (412−5)=(92−5)=−12

∴ a = 5, d = −12

The n^{th} term is given by

$T_n = a + (n-1)\, d$

$T_{14} = 5 + (25 – 1)\, (-1/2) = 5- 12 = -7$

Hence the 25^{th} term is – 7

Question 7:

In the given AP, we have a = 6 and d = (10 – 6) = 4

Suppose there are n terms in the given AP, then

$T_n = 174 \Rightarrow a + (n-1)\, d = 174$

$\Rightarrow 6 + (n-1)\, 4 = 174$

$\Rightarrow 6 + 4n – 4 = 174$

$\Rightarrow 2 + 4n = 174 \Rightarrow n = 172/4 \Rightarrow 43$

Hence there are 43 terms in the given AP

Question 8:

In the given AP we have a = 41 and d = 38 – 41 = – 3

Suppose there are n terms in AP, then

$T_n = 8 \Rightarrow a + (n-1)\, d = 8$

$\Rightarrow 41 + (n-1)\, (-3) = 8$

$\Rightarrow 41 – 3n + 3 = 8$

⇒ -3n = – 36 ⇒ n = 12

Hence there are 12 terms in the given AP

Question 9:

In the given AP, we have a = 3 and d = 8 – 3 = 5

Suppose there are n terms in given AP, then

T_n = a + (n-1) d = 88

⇒ 3 + (n-1) 5 = 88

⇒ 3 + 5n – 5 = 88

⇒ 5n = 90

⇒ n = 12

Hence, the 18th term of given AP is 88

Question 10:

In the given AP, we have a = 72 and d = 68 – 72 = – 4

Suppose there are n terms in given AP, we have

T_n = 0 ⇒ a + (n-1) d = 0

⇒ 72 + (n-1) (-4) = 0

⇒ 72 – 4n + 4 = 0

⇒ 4n = 76

⇒ n = 19

Hence, the 19th term in the given AP is 0

Question 11:

In the given AP, we have a = 12 ; (1−56)=16

Suppose there are n terms in given AP, we have

Then,

$T_n = 3 \Rightarrow a + (n-1)\, d = 3$

$\Rightarrow\ 56+(n-1)16=3$

$\Rightarrow\ 56+16n-16=3$

$\Rightarrow 4 + n = 18$

$\Rightarrow n = 14$

Thus, 14^{th} term in the given AP is 3

Question 12:

We know that $T_1 - (5x + 2)$, $T_2 - (4x - 1)$ and $T_3 - (x + 2)$

Clearly,

$T_2 - T_1 = T_3 - T_2$

$\Rightarrow\ (4x - 1) - (5x + 2) = (x + 2) - (4x - 1)$

$\Rightarrow\ 4x - 1 - 5x - 2 = x + 2 - 4x + 1$

$\Rightarrow\ -x - 3 = -3x + 3$

$\Rightarrow\ -x + 3x = 6$

$\Rightarrow\ 2x = 6 \Rightarrow\ x = 3$

Hence x = 3

Question 13:

$T_n = (4n - 10)$

$\Rightarrow T_1 = (4 \times 1 - 10) = -6$ and $T_2 = (4 \times 2 - 10) = -2$

Thus, we have

(i) First term = -6

(ii) Common difference $= (T_2 - T_1) = (-2+6) = 4$

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(iii) 16^{th} term = a + (16-1) d, where a = -6 and d = 4

= (-6 + 15 x 4) = 54

Question 14:

In the given AP, let first term = a and common difference = d,

Then, T_n = a + (n-1) d

⇒ T_4 = a + (4 – 1)d, T_{10} = a + (10 – 1)d

⇒ T_4 = a + 3d, T_{10} = a + 9d

Now, T_4 = 13 ⇒ a + 3d = 13 – – – (1)

T_{10} = 25 ⇒ a + 9d = 25 – – – (2)

Subtracting (1) from (2), we get

⇒ 6d = 12 ⇒ d = 2

Putting d = 2 in (1), we get

a + 3 x 2 = 13

⇒ a = (13 – 6) = 7

Tthus, a = 7, and d = 2

17^{th} term = a + (17 – 1)d, where a= 7, d = 2

(7 + 16 x 2) = (7 + 32) = 39

∴ a = 7, d = 2,

Question 15:

In the given AP, let first term = a and common difference = d

Then, T_n = a + (n-1) d

⇒ T_8 = a + (8 – 1)d, T_{12} = a + (12 – 1)d

⇒ T_8 = a + 7d, T_{12} = a + 11d

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Now, $T_8 = 37 \Rightarrow a + 7d = 37$ – – – (1)

$T_{12} = 57 \Rightarrow a + 11d = 57$ – – – (2)

Subtracting (1) from (2), we get

$\Rightarrow 4d = 20 \Rightarrow d = 5$

Putting d = 5 in (1), we get

a + 7 x 5 = 37

$\Rightarrow a = 2$

Tthus, a = 2, and d = 5

So the required AP is 2, 7, 12..

Question 16:

In the given AP, let the first term = a, and common difference = d

Then, $T_n = a + (n-1)\,d$

$\Rightarrow T_7 = a + (7 - 1)d$, and $T_{13} = a + (13 - 1)d$

$\Rightarrow T_7 = a + 6d$, $T_{13} = a + 12d$

Now, $T_7 = -4 \Rightarrow a + 6d = -4$ – – – (1)

$T_{13} = -16 \Rightarrow a + 12d = -16$ – – – (2)

Subtracting (1) from (2), we get

$\Rightarrow 6d = -12 \Rightarrow d = -2$

Putting d = -2 in (1), we get

a + 6 (-2) = -4

$\Rightarrow a - 12 = -4$

$\Rightarrow a = 8$

Tthus, a = 8, and d = -2

So the required AP is 8, 6, 4, 2, 0……

Question 17:

In the given AP let the first term = a, And common difference = d

Then, $T_n = a + (n-1)\,d$

$\Rightarrow T_{10} = a + (10 - 1)d$, $T_{17} = a + (17 - 1)d$, $T_{13} = a + (13 - 1)d$

$\Rightarrow T_{10} = a + 9d$, $T_{17} = a + 16d$, $T_{13} = a + 12d$

Now, $T_{10} = 52 \Rightarrow a + 9d = 52$ – – – (1)

and $T_{17} = T_{13} + 20 \Rightarrow a + 16d = a + 12d + 20$

$\Rightarrow 4d = 20 \Rightarrow d = 5$

Putting d = 5 in (1), we get

$a + 9 \times 5 = 52 \Rightarrow a = 52\text{-}45 \Rightarrow a = 7$

Thus, a = 7 and d = 5

So the required AP is 7, 12, 17, 22….

Question 18:

Let the first term of given AP = a and common difference = d

Then, $T_n = a + (n-1)\,d$

$\Rightarrow T_4 = a + (4 - 1)d$, $T_{25} = a + (25 - 1)d$, $T_{11} = a + (11 - 1)d$

$\Rightarrow T_4 = a + 3d$, $T_{25} = a + 24d$, $T_{11} = a + 10d$

Now, $T_4 = 0 \Rightarrow a + 3d = 0 \Rightarrow a = -3d$

$\therefore T_{25} = a + 24d = (-3d + 24d) \Rightarrow 21d$

and $T_{11} = a + 10d = (-3d + 10d) \Rightarrow 7d$

$\therefore T_{25} = 21d = 3 \times 7d = 3 \times T_{11}$

Hence 25th term is triple its 11th term

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Question 19:

The given AP is 3, 8, 13, 18…..

First term a = 3, common difference a = 8 – 3 = 5

∴ T_n = a + (n-1) d = 3 + (n – 1) x 5 = 5n – 2

T_{20} = 3 + (20-1) 5 = 3 + 19 x 5 = 98

Let n^{th} term is 55 more than the 20^{th} term

∴ (5n – 2) – 98 = 55

Or 5n = 100 + 55 = 155

n = 155/5 = 31

∴ 31^{st} term is 55 more than the 20^{th} term of given AP

Question 20:

The given AP is 5, 15, 25….

a = 5, d = 15 – 5 = 10

We have, T_n = 130+T_{31}

⇒ a + (n-1) d = 130 + 5 + (31 – 1) x 10

⇒ 5 + (n-1) 10 = 130 + 5 + (31 – 1) x 10

⇒ 5 + 10n – 10 = 135 + 300

⇒ 10n – 5 = 435 or 10n = 453 + 5

∴ n = 440/10 = 44

Thus, the required term is 44^{th}

Question 21:

First AP is 63, 65, 67….

First term = 63, common difference = 65 – 63 = 2

∴ nth term = 63 + (n – 1) 2 = 63 + 2n – 2 = 2n + 61

Second AP is 3, 10, 17 ….

First term = 3, common difference = 10 – 3 = 7

nth term = 3 + (n – 1) 7 = 3 + 7n – 7 = 7n – 4

The two nth terms are equal

∴ 2n + 61 = 7n – 4 or 5n = 61 + 4 = 65

⇒ n = 65/4 = 13.

Question 22:

Three digit numbers which are divisible by 7 are 105, 112, 119,….994

This is an AP where a= 105, d = 7 and l = 994

Let n^{th} term be 994

∴ a + (n – 1)d =994 or 105 + (n – 1)7 = 994

⇒ 105 + 7n – 7 = 994 or 7n = 94 – 98 = 896

∴ n = 896/7 = 128.

Hence, there are 128 three digits number which are divisible by 7.

Question 23:

Here a = 7, d = (10 – 7) = 3, l = 184

And n = 8

Now, nth term from the end = [l – (n-1) d]

= [184 – (8-1) 3]

= [184 – 7 x 3]

= 184-21

= 163

Hence, the 8^{th} term from the end is 163

Question 24:

Here a = 17, d = (14 – 17) = -3, l = -40

And n = 6

Now, n^{th} term from the end = [l – (n – 1) d]

= [-40 – (6-1)(-3)]

= [-40 + 5 x 3]

= -40+15

= -25

Hence, the 6^{th} term from the end is – 25

Question 25:

The given AP is 10, 7, 4, ….. (-62)

a = 10, d = 7 – 10 = -3, l = -62

Now, 11^{th} term from the end = [l – (n – 1) d]

= [-62 – (11-1)(-3)]

= -62 + 30

= -32

Question 26:

Let a be the first term and d be the common difference

p^{th} term = a +(p – 1)d = q (given) ——(1)

q^{th} term = a +(q – 1) d = p (given) ——(2)

subtracting (2) from (1)

(p – q)d = q – p

$(p - q)d = -(p - q)$

$d = -1$

Putting $d = -1$ in (1)

$a - (p - 1) = q \quad \therefore a = p + q - 1$

$\therefore (p + q)$th term $= a + (p + q - 1)d$

$= (p + q - 1) - (p + q - 1) = 0$

Question 27:

Let a be the first term and d be the common difference

$T_{10} = a + 9d, \quad T_{15} = a + 14d$

$10T_{10} = 15T_{15}$

$\Rightarrow 10(a + 9)\, d = 15(a + 14d)$

$\Rightarrow 2(a + 9)\, d = 3(a + 14d)$

$\Rightarrow a + 24d = 0$

$\therefore T_{25} = 0$

Question 28:

Let a be the first term and d be the common difference

$\therefore$ n^{th} term from the beginning $= a + (n - 1)d$ ——(1)

n^{th} term from end $= l - (n - 1)d$ —-(2)

adding (1) and (2),

sum of the n^{th} term from the beginning and n^{th} term from the end $= [a + (n - 1)d] + [l - (n - 1)d] = a + l$

Question 29:

Number of rose plants in first, second, third rows…. are 43, 41, 39… respectively.

There are 11 rose plants in the last row

So, it is an AP . viz. 43, 41, 39 …. 11

a = 43, d = 41 – 43 = -2, l = 11

Let n^{th} term be the last term

∴ l = a + (n-1) d

⇒ 11 = 43 + (n-1) x (-2)

43 – 2n + 2 = 11 or 2n = 45 -11 = 34

∴ n = 34/2 = 17

Hence, there are 17 rows in the flower bed.

Question 30:

Total amount = ₹ 2800

and number of prizes = 4

Let first prize = ₹ a

Then second prize = ₹ a – 200

Third prize = a – 200 – 200 = a – 400

and fourth prize = a – 400 – 200 = a – 600

But sum of there 4 prizes are ₹ 2800

a + a – 200 + a – 400 + a – 600 = ₹ 2800

⇒ 4a – 1200 = 2800

⇒ 4a = 2800 + 1200 = 4000

⇒ a = 1000

First prize = ₹ 1000

Second prize = ₹ 1000 – 200 = ₹ 800

Third prize = ₹ 800 – 200 = ₹ 600

and fourth prize = ₹ 600 – 200 = ₹ 400

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He was born on January 2, 1946 in a village of Delhi. He graduated from Kirori Mal College, University of Delhi. After completing his M.Sc. in Mathematics in 1969, he joined N.A.S. College, Meerut, as a lecturer. In 1976, he was awarded a fellowship for 3 years and joined the University of Delhi for his Ph.D. Thereafter, he was promoted as a reader in N.A.S. College, Meerut. In 1999, he joined M.M.H. College, Ghaziabad, as a reader and took voluntary retirement in 2003. He has authored more than 75 titles ranging from Nursery to M. Sc. He has also written books for competitive examinations right from the clerical grade to the I.A.S. level.

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