

Arithmetic Progressions - Exercise 5.1

Exercise 5.1 with independently verified solutions.

CHAPTER

Arithmetic Progressions

RESOURCE

NCERT Exercises

SOURCE

NCERT Mathematics, Reprint 2026-27

PART 1

Verified NCERT questions and solutions

Verified NCERT questions and solutions

Solutions are checked independently and follow the supplied NCERT chapter edition.

QUESTION

Question 1

identifying an AP · application

Decide whether these situations form APs and why: (i) taxi fare ₹15 first km plus ₹8 each extra km; (ii) a pump removes $\frac{1}{4}$ of remaining air each time; (iii) well digging costs ₹150 first metre plus ₹50 each next metre; (iv) ₹10000 at 8% compound interest.

Solution

Board-exam working:

(i) Taxi fare: Fare for 1 km=₹15.

Fare for 2 km=₹15+₹8=₹23.

Fare for 3 km=₹23+₹8=₹31.

Therefore, the list of fares is 15,23,31,....

Difference between the second and first terms= $23-15=8$.

Difference between the third and second terms= $31-23=8$.

Since the consecutive differences are equal, the taxi fares form an AP with common difference $d=8$.

(ii) Air remaining in the cylinder: Let the initial quantity of air be V .

After the first operation, air remaining $= V - V/4 = 3V/4$.

After the second operation, air remaining $= 3V/4 - (1/4)(3V/4) = 3V/4 - 3V/16 = 9V/16$.

After the third operation, air remaining $= 9V/16 - (1/4)(9V/16) = 9V/16 - 9V/64 = 27V/64$.

Therefore, the list is $V, 3V/4, 9V/16, 27V/64, \dots$

Second term - first term $= 3V/4 - V = -V/4$.

Third term - second term $= 9V/16 - 3V/4 = 9V/16 - 12V/16 = -3V/16$.

Since $-V/4 \neq -3V/16$, the consecutive differences are not equal.

Hence the list is not an AP.

(iii) Cost of digging the well: Cost of the first metre = ₹150.

Cost of the second metre $= ₹150 + ₹50 = ₹200$.

Cost of the third metre $= ₹200 + ₹50 = ₹250$.

Therefore, the list of costs is $150, 200, 250, \dots$

Difference between the second and first terms $= 200 - 150 = 50$.

Difference between the third and second terms $= 250 - 200 = 50$.

Since the consecutive differences are equal, the costs form an AP with common difference $d=50$.

(iv) Compound interest: Principal=₹10000 and rate=8% per annum.

Amount after the first year= $10000 + (8/100) \times 10000 = 10000 + 800 = ₹10800$.

Amount after the second year= $10800 + (8/100) \times 10800 = 10800 + 864 = ₹11664$.

Amount after the third year= $11664 + (8/100) \times 11664 = 11664 + 933.12 = ₹12597.12$.

Therefore, the list of yearly amounts is 10000,10800,11664,12597.12,....

Second term–first term= $10800 - 10000 = 800$.

Third term–second term= $11664 - 10800 = 864$.

Since $800 \neq 864$, the consecutive differences are not equal.

Hence the list is not an AP.

Final answer

(i) AP, $d=8$; (ii) not an AP; (iii) AP, $d=50$; (iv) not an AP.

QUESTION

Question 2

sequence generation

Write four terms for: (i) $a=10, d=10$; (ii) $a=-2, d=0$; (iii) $a=4, d=-3$; (iv) $a=-1, d=1/2$; (v) $a=-1.25, d=-0.25$.

Solution

Board-exam working:

To obtain each next term, add the common difference d to the preceding term.

(i) Given $a=10$ and $d=10$.

First term: $a_1=10$.

Second term: $a_2=a_1+d=10+10=20$.

Third term: $a_3=a_2+d=20+10=30$.

Fourth term: $a_4=a_3+d=30+10=40$.

Hence the first four terms are 10,20,30,40.

(ii) Given $a=-2$ and $d=0$.

First term: $a_1=-2$.

Second term: $a_2=-2+0=-2$.

Third term: $a_3=-2+0=-2$.

Fourth term: $a_4=-2+0=-2$.

Hence the first four terms are -2,-2,-2,-2.

(iii) Given $a=4$ and $d=-3$.

First term: $a_1=4$.

Second term: $a_2=4+(-3)=1$.

Third term: $a_3=1+(-3)=-2$.

Fourth term: $a_4=-2+(-3)=-5$.

Hence the first four terms are 4,1,-2,-5.

(iv) Given $a=-1$ and $d=1/2$.

First term: $a_1=-1$.

Second term: $a_2=-1+1/2=-1/2$.

Third term: $a_3=-1/2+1/2=0$.

Fourth term: $a_4 = 0 + 1/2 = 1/2$.

Hence the first four terms are $-1, -1/2, 0, 1/2$.

(v) Given $a = -1.25$ and $d = -0.25$.

First term: $a_1 = -1.25$.

Second term: $a_2 = -1.25 + (-0.25) = -1.50$.

Third term: $a_3 = -1.50 + (-0.25) = -1.75$.

Fourth term: $a_4 = -1.75 + (-0.25) = -2.00$.

Hence the first four terms are $-1.25, -1.50, -1.75, -2.00$.

Final answer

(i) 10, 20, 30, 40; (ii) $-2, -2, -2, -2$; (iii) 4, 1, $-2, -5$; (iv) $-1, -1/2, 0, 1/2$; (v) $-1.25, -1.50, -1.75, -2.00$.

QUESTION

Question 3

first term · common difference

For each AP state a and d : (i) 3, 1, $-1, -3, \dots$ (ii) $-5, -1, 3, 7, \dots$ (iii) $1/3, 5/3, 9/3, 13/3, \dots$ (iv) 0.6, 1.7, 2.8, 3.9, $\dots$

Solution

Board-exam working:

For an AP, the first term is a and the common difference is $d = a_2 - a_1$.

We verify d using every consecutive pair shown.

(i) The AP is 3, 1, -1, -3,

Therefore $a=3$.

$$a_2 - a_1 = 1 - 3 = -2.$$

$$a_3 - a_2 = -1 - 1 = -2.$$

$$a_4 - a_3 = -3 - (-1) = -3 + 1 = -2.$$

All differences are equal.

Hence $d=-2$.

(ii) The AP is -5, -1, 3, 7,

Therefore $a=-5$.

$$a_2 - a_1 = -1 - (-5) = -1 + 5 = 4.$$

$$a_3 - a_2 = 3 - (-1) = 3 + 1 = 4.$$

$$a_4 - a_3 = 7 - 3 = 4.$$

All differences are equal.

Hence $d=4$.

(iii) The AP is $1/3, 5/3, 9/3, 13/3, \dots$

Therefore $a=1/3$.

$$a_2 - a_1 = 5/3 - 1/3 = (5-1)/3 = 4/3.$$

$$a_3 - a_2 = 9/3 - 5/3 = (9-5)/3 = 4/3.$$

$$a_4 - a_3 = 13/3 - 9/3 = (13-9)/3 = 4/3.$$

All differences are equal.

Hence $d=4/3$.

(iv) The AP is 0.6,1.7,2.8,3.9,....

Therefore $a=0.6$.

$$a_2 - a_1 = 1.7 - 0.6 = 1.1.$$

$$a_3 - a_2 = 2.8 - 1.7 = 1.1.$$

$$a_4 - a_3 = 3.9 - 2.8 = 1.1.$$

All differences are equal.

Hence $d=1.1$.

Final answer

(i) $a=3, d=-2$; (ii) $a=-5, d=4$; (iii) $a=1/3, d=4/3$; (iv) $a=0.6, d=1.1$.

QUESTION

Question 4

identifying an AP

Determine which form APs, give d and three next terms: (i) 2,4,8,16 (ii) 2,5/2,3,7/2 (iii) -1.2,-3.2,-5.2,-7.2 (iv) -10,-6,-2,2 (v) $3, 3+\sqrt{2}, 3+2\sqrt{2}, 3+3\sqrt{2}$ (vi) 0.2,0.22,0.222,0.2222 (vii) 0,-4,-8,-12 (viii) $-1/2$ repeated (ix) 1,3,9,27 (x) $a, 2a, 3a, 4a$ (xi) a, a^2, a^3, a^4 (xii) $\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32}$ (xiii) $\sqrt{3}, \sqrt{6}, \sqrt{9}, \sqrt{12}$ (xiv) $1^2, 3^2, 5^2, 7^2$ (xv) $1^2, 5^2, 7^2, 73$.

Solution

Board-exam working:

A list is an AP only when all its consecutive differences are equal.

(i) $4-2=2$, $8-4=4$ and $16-8=8$.

Since 2, 4 and 8 are unequal, the list is not an AP.

(ii) $5/2-2=5/2-4/2=1/2$.

$3-5/2=6/2-5/2=1/2$.

$7/2-3=7/2-6/2=1/2$.

The differences are equal, so it is an AP with $d=1/2$.

The next terms are $7/2+1/2=4$, $4+1/2=9/2$ and $9/2+1/2=5$.

(iii) $-3.2-(-1.2)=-3.2+1.2=-2$.

$-5.2-(-3.2)=-5.2+3.2=-2$.

$-7.2-(-5.2)=-7.2+5.2=-2$.

The differences are equal, so it is an AP with $d=-2$.

The next terms are $-7.2-2=-9.2$, $-9.2-2=-11.2$ and $-11.2-2=-13.2$.

(iv) $-6-(-10)=4$, $-2-(-6)=4$ and $2-(-2)=4$.

Therefore it is an AP with $d=4$.

The next terms are $2+4=6$, $6+4=10$ and $10+4=14$.

(v) $(3+\sqrt{2})-3=\sqrt{2}$.

$(3+2\sqrt{2})-(3+\sqrt{2})=\sqrt{2}$.

$(3+3\sqrt{2})-(3+2\sqrt{2})=\sqrt{2}$.

Therefore it is an AP with $d=\sqrt{2}$.

The next terms are $3+4\sqrt{2}$, $3+5\sqrt{2}$ and $3+6\sqrt{2}$.

(vi) $0.22-0.2=0.02$, $0.222-0.22=0.002$ and $0.2222-0.222=0.0002$.

Since the differences are unequal, the list is not an AP.

(vii) $-4-0=-4$, $-8-(-4)=-4$ and $-12-(-8)=-4$.

Therefore it is an AP with $d=-4$.

The next terms are $-12-4=-16$, $-16-4=-20$ and $-20-4=-24$.

(viii) Every term is $-1/2$.

Thus $(-1/2)-(-1/2)=0$ for every consecutive pair.

Therefore it is an AP with $d=0$.

The next three terms are $-1/2, -1/2, -1/2$.

(ix) $3-1=2$, $9-3=6$ and $27-9=18$.

Since the differences are unequal, the list is not an AP.

(x) $2a - a = a$, $3a - 2a = a$ and $4a - 3a = a$.

Therefore it is an AP with $d = a$.

The next terms are $4a + a = 5a$, $5a + a = 6a$ and $6a + a = 7a$.

(xi) $a^2 - a$, $a^3 - a^2 = a^2(a - 1)$ and $a^4 - a^3 = a^3(a - 1)$ are not equal for a general value of a .

Hence the list is not an AP.

(xii) First simplify $\sqrt{8} = 2\sqrt{2}$, $\sqrt{18} = 3\sqrt{2}$ and $\sqrt{32} = 4\sqrt{2}$.

The list becomes $\sqrt{2}, 2\sqrt{2}, 3\sqrt{2}, 4\sqrt{2}, \dots$

$2\sqrt{2} - \sqrt{2} = \sqrt{2}$, $3\sqrt{2} - 2\sqrt{2} = \sqrt{2}$ and $4\sqrt{2} - 3\sqrt{2} = \sqrt{2}$.

Therefore it is an AP with $d = \sqrt{2}$.

The next terms are $5\sqrt{2} = \sqrt{50}$, $6\sqrt{2} = \sqrt{72}$ and $7\sqrt{2} = \sqrt{98}$.

(xiii) $\sqrt{6} - \sqrt{3}$, $\sqrt{9} - \sqrt{6} = 3 - \sqrt{6}$ and $\sqrt{12} - \sqrt{9} = 2\sqrt{3} - 3$ are unequal.

Hence the list is not an AP.

(xiv) First write the values: $1^2=1$, $3^2=9$, $5^2=25$ and $7^2=49$.

The differences are $9-1=8$, $25-9=16$ and $49-25=24$.

Since they are unequal, the list is not an AP.

(xv) First write the values: $1^2=1$, $5^2=25$ and $7^2=49$.

The list is 1,25,49,73,....

$25-1=24$, $49-25=24$ and $73-49=24$.

Therefore it is an AP with $d=24$.

The next terms are $73+24=97$, $97+24=121$ and $121+24=145$.

Final answer

(ii) $d=1/2$, next terms $4, 9/2, 5$; (iii) $d=-2$, next terms $-9.2, -11.2, -13.2$; (iv) $d=4$, next terms $6, 10, 14$; (v) $d=\sqrt{2}$, next terms $3+4\sqrt{2}, 3+5\sqrt{2}, 3+6\sqrt{2}$; (vii) $d=-4$, next terms $-16, -20, -24$; (viii) $d=0$, next terms $-1/2, -1/2, -1/2$; (x) $d=a$, next terms $5a, 6a, 7a$; (xii) $d=\sqrt{2}$, next terms $\sqrt{50}, \sqrt{72}, \sqrt{98}$; (xv) $d=24$, next terms $97, 121, 145$. Parts (i), (vi), (ix), (xi), (xiii), (xiv) are not APs.