

MathQuest: Difference Equations

Sequences and Difference Equations

1. If the general term for a sequence is $a_n = 4 + 6n$ then
 - (a) $a_3 = 10$
 - (b) $a_3 = 16$
 - (c) $a_3 = 22$
 - (d) $a_3 = 28$
2. Consider the difference equation $a_{n+1} = -3a_n + 5$ with the initial condition $a_0 = 1$. What is a_3 ?
 - (a) $a_3 = 8$
 - (b) $a_3 = -19$
 - (c) $a_3 = -1$
 - (d) $a_3 = 2$
3. Consider the difference equation $a_{n+1} = 2a_n + n$ with the initial condition $a_0 = 1$. What is a_2 ?
 - (a) $a_2 = 4$
 - (b) $a_2 = 5$
 - (c) $a_2 = 8$
 - (d) $a_2 = 27$
4. The sequence $0, 1, 2, 3, 4, \dots$ can be represented by which discrete dynamical system (difference equation and initial condition)?
 - (a) $a_{n+1} = a_n + 1$ with $a_0 = 0$
 - (b) $a_{n+3} = a_{n+2} + 1$ with $a_0 = 0$
 - (c) $b_{k+2} = b_{k+1} + 1$ with $b_0 = 0$
 - (d) $a_{n+1} = a_n + 1$ with $a_4 = 4$
 - (e) All of the above
 - (f) None of the above

5. The sequence $0, 2, 4, 6, 8, \dots$ can be represented by which discrete dynamical system (difference equation and initial condition)?
- (a) $a_{n+1} = 2a_n$ with $a_0 = 0$
 - (b) $a_{n+1} = a_n + 2$ with $a_0 = 0$
 - (c) $a_n = 2a_n$ with $a_0 = 0$
 - (d) $a_n = a_n + 2$ with $a_0 = 0$
 - (e) None of the above
6. Given the sequence $0, 2, 4, 6, 8, \dots$, what is the a_n , noting that $a_0 = 0$?
- (a) $a_n = n + 2$
 - (b) $a_n = 2^n$
 - (c) $a_n = n^2$
 - (d) $a_n = 2n$
7. **True or False** The sequences $0, 2, 4, 6, 8, \dots$ and $2, 4, 6, 8, \dots$ are represented by the same difference equation, $a_{n+1} = a_n + 2$.
- (a) True, and I am very confident
 - (b) True, but I am not very confident
 - (c) False, but I am not very confident
 - (d) False, and I am very confident
8. **True or False** The sequences $0, 2, 4, 6, 8, \dots$ and $2, 4, 6, 8, \dots$ have the same n^{th} term.
- (a) True, and I am very confident
 - (b) True, but I am not very confident
 - (c) False, but I am not very confident
 - (d) False, and I am very confident
9. Which difference equation represents the sequence $15, 30, 60, 120, 240, \dots$?
- (a) $a_{n+1} = a_n + 15$
 - (b) $a_{n+1} = 15a_n$
 - (c) $a_{n+1} = 2a_n$
 - (d) None of the above

10. Given the sequence 15, 30, 60, 120, 240, ..., what is the a_n , noting that $a_0 = 15$?

- (a) $a_n = n + 15$
- (b) $a_n = 2^n$
- (c) $a_n = 2^n(15)$
- (d) $a_n = n^2$
- (e) $a_n = 2n$
- (f) None of the above

11. Which difference equation represents the sequence 10, 7, 4, 1, -2, ...?

- (a) $a_{n+1} - a_n = -3$
- (b) $a_{n+1} = 3 - a_n$
- (c) $a_{n+1} = \frac{7}{10}a_n$
- (d) None of the above

12. Given the sequence 10, 7, 4, 1, -2, ..., what is the a_n , noting that $a_0 = 10$?

- (a) $a_n = n - 3$
- (b) $a_n = 3 - n$
- (c) $a_n = 10 - n$
- (d) $a_n = 10 - 3n$
- (e) None of the above

13. Which of the following represents the general term for the sequence 7, 5, 7, 5, 7, ...?

- (a) $a_n = 6 - (-1)^n$
- (b) $a_n = 6 + (-1)^n$
- (c) $a_n = 7 - 2n$
- (d) $a_n = 5 + (-2)^n$

14. Which difference equation represents the sequence 1, 3, 6, 10, 15, 21, ...?

- (a) $a_{n+1} = a_n + 2$
- (b) $a_{n+1} = a_n + 3$
- (c) $a_{n+1} = a_n + n$

(d) None of the above

15. Which of the following difference equations describes the sequence $a_0 = 10, a_1 = 9, a_2 = 7, a_3 = 4, a_4 = 0, a_5 = -5, \dots$.

(a) $a_{n+1} = a_n - n$

(b) $a_{n+1} = a_n - 1$

(c) $a_{n+1} = a_n - n - 1$

(d) $a_{n+1} = a_n - n^2 - 1$

16. Which difference equation represents the sequence $1, 1, 2, 3, 5, 8, \dots$?

(a) $a_{n+1} = a_n + 1$

(b) $a_{n+2} = a_n + 3$

(c) $a_{n+2} = a_{n+1} + a_n$

(d) None of the above

17. If the general term of a sequence is $a_n = 2n - 4$ which of the following difference equations work?

(a) $a_{n+1} = a_n + 2$

(b) $a_{n+1} = 2a_n - 4$

(c) $a_{n+1} = a_n + 2n$

(d) $a_{n+1} = 4a_n - 2$

18. If a sequence follows the difference equation $a_{n+1} = a_n + 4$ with the initial condition $a_0 = -3$, which of the following general terms describes the sequence?

(a) $a_n = 4 - 3n$

(b) $a_n = 4 + n$

(c) $a_n = -3 \cdot (4n)$

(d) $a_n = -3 + 4n$

19. Which of the following sequences follows the difference equation $a_{n+1} = 2a_n - n^2$?

(a) $a_0 = 2, a_1 = 4, a_2 = 7, a_3 = 10, \dots$

(b) $a_0 = 1, a_1 = 2, a_2 = 3, a_3 = 2, \dots$

- (c) $a_0 = 0, a_1 = 0, a_2 = -1, a_3 = -6, \dots$
- (d) $a_0 = -1, a_1 = -2, a_2 = -5, a_3 = -14, \dots$
- (e) All of the above

20. Which of the following is *not* a difference equation?

- (a) $a_{n+2} = 3a_n + 5$
- (b) $b_n - b_{n-1} = 3$
- (c) $c_n = 5n + 2$
- (d) $d_n = 3n + d_{n+1}$
- (e) All of these are difference equations.
- (f) None of these are difference equations.