

MathQuest: Difference Equations

Solving Difference Equations

1. The solution to $a_{n+1} = 5.2a_n$ with $a_0 = 6$ is

- (a) $a_n = 6^n(5.2)$
- (b) $a_n = 6^n C$
- (c) $a_n = 5.2^n(6)$
- (d) $a_n = 5.2n + 6$
- (e) $a_n = 5.2^n(3)$

2. The solution to $a_{n+1} = 3a_n$ with $a_2 = 5$ is

- (a) $a_n = 3^n(5)$
- (b) $a_n = 5^n(3)$
- (c) $a_n = 3^n\left(\frac{5}{9}\right)$
- (d) None of the above

3. The solution to $c_{n+1} = c_n - 7$ with $c_0 = 2$ is

- (a) $c_n = 2 - 7n$
- (b) $c_n = 2 + 7n$
- (c) $c_n = 7 - 2n$
- (d) $c_n = 7 + 2n$

4. The solution to $a_{n+3} = a_{n+2} + 9$ with $a_3 = 5$ is

- (a) $a_n = 9n + 5$
- (b) $a_n = 5n + 9$
- (c) $a_n = 9n - 22$
- (d) We don't know how to solve difference equations that are in this form.

5. Which best describes the long-term behavior of the solution $a_n = 1.13^n(5)$?

- (a) This solution will increase to infinity.
 - (b) This solution will increase, approaching equilibrium at infinity.
 - (c) This solution will decrease, approaching equilibrium at zero.
 - (d) None of the above
6. Which best describes the equilibrium of the difference equation with solution $a_n = 0.87^n(2.45)$?
- (a) There is a stable equilibrium at zero.
 - (b) There is an unstable equilibrium at zero.
 - (c) There is a stable equilibrium at 2.45.
 - (d) There is an unstable equilibrium at 2.45.
 - (e) There is no equilibrium.
 - (f) We can't answer this without knowing the difference equation.
7. Which best describes the equilibrium of the difference equation with solution $a_n = 1.54^n C$?
- (a) There is a stable equilibrium at zero.
 - (b) There is an unstable equilibrium at zero.
 - (c) There is a stable equilibrium somewhere other than zero.
 - (d) There is an unstable equilibrium somewhere other than zero.
 - (e) There is no equilibrium.
 - (f) We can't answer this without knowing C .
8. Which best describes the equilibrium of the difference equation with solution $a_n = 3n + 5$?
- (a) There is a stable equilibrium at zero.
 - (b) There is an unstable equilibrium at zero.
 - (c) There is a stable equilibrium at 5.
 - (d) There is an unstable equilibrium at 5.
 - (e) There is no equilibrium.
 - (f) We can't answer this without knowing the difference equation.
9. Which best describes the long-term behavior of the solution $a_n = (-2)^n(12)$?

- (a) As n gets large, the values of a_n grow without bound.
- (b) As n gets large, the values of a_n decrease without bound.
- (c) As n gets large, the values of a_n oscillate, getting farther and farther from zero.
- (d) As n gets large, the values of a_n oscillate, getting closer and closer to zero.
- (e) None of the above
10. What difference equation has the solution $a_n = 0.3^n(0.7)$?
- (a) $a_{n+1} = 0.7a_n$
- (b) $a_{n+1} = 0.3a_n$
- (c) $a_{n+1} = 0.7a_n + 0.3$
- (d) $a_{n+1} = 0.3a_n + 0.7$
- (e) None of the above
11. What discrete dynamical system has the solution $a_n = 1.5^n(2)$?
- (a) $a_{n+1} = 2a_n$ with $a_0 = 1.5$
- (b) $a_{n+1} = 1.5a_n$ with $a_0 = 2$
- (c) $a_{n+1} = 2a_n + 1.5$ with a_0 unknown
- (d) $a_{n+1} = 1.5a_n + 2$ with a_0 unknown
12. What discrete dynamical system has the solution $a_n = 5 - 4n$?
- (a) $a_{n+1} = a_n - 4$ with $a_0 = 5$
- (b) $a_{n+1} = a_n + 5$ with $a_0 = -4$
- (c) $a_{n+1} = 5a_n$ with $a_0 = -4$
- (d) $a_{n+1} = -4a_n$ with $a_0 = 5$
13. Suppose $a_n = 3 \cdot 2^n$ solves a certain linear homogeneous difference equation. What other function also must solve the difference equation?
- (a) $a_n = 3 \cdot 2^n + 1$
- (b) $b_n = \frac{4}{5} \cdot 3 \cdot 2^n$
- (c) $c_n = 2^n - 3^n$
- (d) $d_n = 3$
- (e) All of the above
- (f) None of the above