

MathQuest: Difference Equations

Differences and Derivatives

1. The first difference, $f(n + 1) - f(n)$,
 - (a) is exactly the same as the first derivative.
 - (b) is a discrete approximation of the first derivative.
 - (c) is not very helpful for learning about functions.
 - (d) None of the above
2. The first difference can
 - (a) pinpoint exactly where a function has a critical point.
 - (b) pinpoint exactly where a function changes concavity.
 - (c) approximate the location of a function's critical points.
 - (d) approximate the location of a function's inflection point.
 - (e) None of the above
3. The second difference can
 - (a) pinpoint exactly where a function has a critical point.
 - (b) pinpoint exactly where a function changes concavity.
 - (c) approximate the location of a function's critical points.
 - (d) approximate the location of a function's inflection point.
 - (e) None of the above
4. If we sample $f(x) = 3x + b$ using step sizes of 1, what are the first differences?
 - (a) 0
 - (b) 1
 - (c) 1.5
 - (d) 3
 - (e) Cannot determine without knowing b .
5. If we sample $f(x) = 3x + b$ using step sizes of 0.5, what are the first differences?

- (a) 0
 - (b) 1
 - (c) 1.5
 - (d) 3
 - (e) Cannot determine without knowing b .
6. If we sample $f(x) = 3x + b$ using step sizes of 0.5, what are the second differences?
- (a) 0
 - (b) 0.5
 - (c) 1
 - (d) 3
 - (e) Cannot determine without knowing b .
7. If we sampled a second degree polynomial in step sizes of 1, what would the second differences be?
- (a) 0
 - (b) 0.5
 - (c) 1
 - (d) 2
 - (e) Cannot determine without knowing the polynomial.
8. If we sampled the function $f(x) = x^2 + bx + c$ in step sizes of 0.5, what would the second differences be?
- (a) 0
 - (b) 0.5
 - (c) 1
 - (d) 2
 - (e) 4
 - (f) Cannot determine without knowing the polynomial.
9. The phrase “ y is proportional to x ” means
- (a) $y = kx$
 - (b) if x doubles, then y doubles.

- (c) a graph of y versus x would always go through the origin.
- (d) All of the above
- (e) None of the above
10. If the change in population is proportional to the population size, with proportionality constant k , we can say
- (a) $a_{n+1} = ka_n$
- (b) $\Delta a_n = ka_n$
- (c) $a_n = k$
- (d) All of the above
- (e) None of the above
11. In the year 2000 the population of the US was 281 million, and our population grows by about ten percent every decade. Formulate a difference equation to model the population of the US.
- (a) $\Delta a_n = 0.1a_n$
- (b) $a_{n+1} = 1.1a_n$
- (c) $\frac{\Delta a_n}{a_n} = 0.1$
- (d) All of the above
- (e) None of the above
12. A difference equation to model the population of frogs is $\Delta f_n = 0.2f_n$, where n is in years. What is a verbal description of this scenario?
- (a) The frog population is increasing at a rate of 20 percent per year.
- (b) The size of the frog population next year will be 120% of this year's population size.
- (c) The change in the frog population is proportional to the current population, with constant of proportionality equal to 0.2.
- (d) All of the above
- (e) None of the above