Started on	Wednesday, 7 July 2021, 10:48 AM
State	Finished
Completed on	Wednesday, 7 July 2021, 10:58 AM
Time taken	10 mins 27 secs
Marks	12.50/12.50
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 1.50 out of 1.50

8221238

Find the explicit formula for the Fibonacci sequence.

(Note that the Fibonacci sequence is originally defined by $f_n = f_{n-1} + f_{n-2} (n \geq 2)$ with $f_0 = 0, f_1 = 1$)

Select one:

- a. $f_n = 0 (n \geq 0)$.
- b. $f_n = \frac{1}{\sqrt{5}}\left(\frac{1+\sqrt{5}}{2}\right)^n - \frac{1}{\sqrt{5}}\left(\frac{1-\sqrt{5}}{2}\right)^n (n \geq 0)$. ✔
- c. $f_n = 1 (n \geq 0)$.
- d. $f_n = \left(\frac{1+\sqrt{5}}{2}\right)^n + \left(\frac{1-\sqrt{5}}{2}\right)^n (n \geq 0)$.

Question **2**

Correct

Mark 1.00 out of 1.00

8221238

Which is the characteristic equation of the recurrence relation $a_n = 5a_{n-1}$?

Select one:

- a. $r - 5 = 0$ ✔
- b. $r^2 = 0$
- c. $r^2 - 5r = 0$
- d. $r^2 = 5$

Question **3**

Correct

Mark 1.00 out of 1.00

8221238

Knowing that the population of the world in 2002 was 6.2 billion and the annual growing rate of the population is 1.3%. What is the population n years after 2002?

Select one:

- a. 6.2 (billion).
- b. None of these.
- c. $(1.013)^n$ (billion).
- d. $6.2(1.013)^n$ (billion). ✔

Question **4**

Correct

Mark 1.00 out of 1.00

8221238

The characteristic equation of the recurrence relation $a_n = 10a_{n-1} - 25a_{n-2}$ has

Select one:

- a. a repeated root. ✔
- b. two distinct roots.
- c. no root.
- d. None of these.

Question **5**

Correct

Mark 1.00 out of 1.00

8221238

Which of these are linear homogeneous recurrence relations with constant coefficients

1. $a_n = 2a_{n-1}$
2. $a_n = a_{n-1} + na_{n-2}$
3. $a_n = a_{n-1}^2$
4. $a_n = a_{n-1} + 3$

Select one:

- a. 4
- b. 2
- c. 3
- d. 1 ✔

Question **6**

Correct

Mark 1.00 out of 1.00

8221238

Which of the followings is the solution to the relation $a_n = 10a_{n-1} (n \geq 1)$.

(The number of correct answers may be more than 1. Please choose all the correct answers (answer).)

Select one or more:

- a. $a_n = a_0.10^n (n \geq 0)$. ✔
- b. $a_n = 10^n (n \geq 0)$. ✔
- c. $a_n = (-10)^n (n \geq 0)$.
- d. The relation has no solution.

Question **7**

Correct

Mark 1.00 out of 1.00

8221238

A sequence is a solution to the relation $a_n = 4a_{n-1} - 4a_{n-2} (n \geq 2)$ if and only if

Select one:

- a. $a_n = \alpha_1 2^n + \alpha_2 n 2^n (n \geq 0)$ (α_1,α_2 are arbitrary constants). ✔
- b. $a_n = \alpha_1 2^n + \alpha_2 2^n (n \geq 0)$ (α_1,α_2 are arbitrary constants).
- c. $a_n = 4^n (n \geq 0)$.
- d. $a_n = (-4)^n (n \geq 0)$.

Question **8**

Correct

Mark 1.00 out of 1.00

8221238

A sequence is a solution to the relation $a_n = 5a_{n-1} - 6a_{n-2} (n \geq 2)$ if and only if

Select one:

- a. $a_n = \alpha_1 2^n + \alpha_2 3^n (n \geq 0)$ (α_1,α_2 are arbitrary constants). ✔
- b. $a_n = 1 (n \geq 0)$.
- c. $a_n = \alpha_1 5^n + \alpha_2 (-6)^n (n \geq 0)$ (α_1,α_2 are arbitrary constants).
- d. $a_n = \alpha_1 2^n + \alpha_2 n 3^n (n \geq 0)$ (α_1,α_2 are arbitrary constants).

Question **9**

Correct

Mark 1.00 out of 1.00

8221238

Which of these are linear homogeneous recurrence relations with constant coefficients

Select one:

- a. $a_n = \frac{a_{n-1}}{a_{n-2}}$
- b. $a_n = a_{n-1}^3 + a_{n-2}$
- c. $a_n = a_{n-1} - a_{n-2}$ ✔
- d. $a_n = a_{n-1} + a_{n-3} + 1$

Question **10**

Correct

Mark 1.00 out of 1.00

8221238

What is the characteristic equation of the relation $a_n = -3a_{n-1} + 10a_{n-2}$?

Select one:

- a. $r^2 = 3r.$
- b. $r^2 + 3r - 10 = 0.$ ✔
- c. $r^2 - 3r + 10 = 0.$
- d. $r^2 = 10.$

Question **11**

Correct

Mark 1.00 out of 1.00

8221238

The relation $a_n = c_1 a_{n-1} + c_2 a_{n-2}\,(n \geq 2)$, with given initial values a_0, a_1; has

Select one:

- a. None of these.
- b. no solution.
- c. a unique solution. ✔
- d. many solutions.

Question **12**

Correct

Mark 1.00 out of 1.00

8221238

A sequence is called a solution to a given recurrence relation $a_n = c_1 a_{n-1} + c_2 a_{n-2}\,(n \geq 2)$ if the sequence satisfies the relation

Select one:

- a. for $n \geq 2$. ✔
- b. for all $n \geq 0$.
- c. for n=2.
- d. for n=0.

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