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Test

Name: Maanya
Start time: 15:34
End time: 16:53

2019

Q1) a) $2500 \times 0.93 = 2325$ M1

$+\ 250$

$= 2575$ A1

2020

$2575 \times 0.93 = 2394.75$

$+\ 250$ M1

$2020: 2500 \times 0.93^2 + 250(0.93+1)$

$= 2644.75$

$\approx \underline{2645 \text{ fish}}$

b) $2042: 2500 \times 0.93^{24} + 250(0.93^{23} + 0.93^{22} + 0.93^{21} \ldots + 1)$ M1A1

$= 2500 \times 0.93^{24} + 250\dfrac{(0.93^{24} - 1)}{0.93 - 1}$ M1

$= 3383.684$ A1

$\approx \underline{3384 \text{ fish}}$ A1

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Q2)

a) $u_1 = \left(\frac{\cancel{2}^{1}}{3}\right)\left(\frac{7}{\cancel{8}_{4}}\right)$ M1

$= \frac{7}{12}$ A1

b) $S_\infty = \dfrac{\frac{7}{12}}{1 - \frac{7}{8}}$ A1M1

$= \frac{14}{3}$ A1

c) $S_\infty - S_n < 0.001$ M1

$\frac{14}{3} - \sum_{r=1}^{n} \frac{2}{3}\left(\frac{7}{8}\right)^r < 0.001$ M1

[Using GDC]

$n = 63.2835$ A1

$n = 64$ A1

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Q3)

$u_1 = 50$

$u_4 = 86.4$

$50r^3 = 86.4$ A1

$r = 1.155..$

$= 1.2$ A1

$S_n = \dfrac{50(1.2^n - 1)}{1.2 - 1} = 33500$ A1

⋮

$\log_{1.2}(135)$ M1

$= 26.9045..$

≈ 27 years.

$n = 27$ A1

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Q4) N/A

Q5) [Using GDC] M1

$1.52 < x < 1.786$ A1A1A1

and

$17.59 < x < 19.10$ A1A1

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Q6)

a) (i) $\dfrac{2^{u_{n+1}}}{2^{u_n}}$ M1

$= 2^{u_{n+1} - u_n}$

$= 2^d$ A1

(ii) 2^{u_1} A1

(iii) $\boxed{u_n = u_1 r^{n-1}}$

$v_n = 2^a(2d)^{n-1}$ A1

b)

(i) $\cancel{\frac{2^a((2d)^n-1)}{2d-1}}$ $\frac{2^a((2^d)^n-1)}{2^d-1}$ M1

$\cancel{= \frac{2^a(2^{dn}-1)}{2^d-1}}$ $= \frac{2^a(2^{dn}-1)}{2^d-1}$ A1

(ii) $|r|<1$

$\cancel{-1<2d)}$ $-1<2^d<1$ R1

$d<0$ A1

(iii) $S_\infty = \frac{2^a}{1-2^d}$ A1

(iv) $\frac{2^a}{1-2^d} = 2^{a+1}$

$\frac{1}{1-2^d} = 2^1 = 2$ M1

$1 = 2-(2\cdot 2^d)$

$1 = 2^1 - 2^{d+1}$

$-2 \quad -2$

$2^{d+1} = 1$

$d+1 = 0$

$d = -1$ A1

c)

$$\sum_{i=1}^{n} z_i = \ln p + \ln pq + \ln pq^2 + \ln pq^3 + \dots + \ln pq^{(n-1)}$$ M1A1

$$= \ln\left(p^n q^{(1+2+3+\dots+(n-1))}\right)$$ M1A1

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Q7)

$a = 2n+1$ M1A1 REDO

$b = 2m+1$

$4n^2+1 + 4m^2+1$

$= 4n^2 + 4m^2 + 2$

divisible divisible not divisible

Hence proven by contradiction, a and b cannot both be odd. AG

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Q8) Assume $x \in \mathbb{Z}$ M1

$2x^3 + 6x = -1$ A1

if $x \in \mathbb{Z}$ then $2x^3+6x$ is even. But -1 is not even. R1 R1

Hence proven by contradiction that $2x^3+6x+1$ has no integer roots. AG

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Q9) N/A

Q10)

a)

$x < -0.968$

$1 < x < 5$ A1A1

b)

$-3.19 < x < -2.79$

$\cup$

$1.79 < x < 2.19$ A1A1

[Using GDC]

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Q11) N/A

Q12) N/A

Q13) N/A

Q14) N/A