| Question Number | Scheme | Marks |
|---|---|---|
| **4 (a)** | $\frac{a\left(1-r^3\right)}{1-r}=70.2\ ,\ \frac{a}{1-r}=75$ | B1, B1 |
| | Sub (2) in (1) $\quad 75\left(1-r^3\right)=70.2\Rightarrow r^3=\left(0.064\right)$ | M1 |
| | $r=0.4$ | A1 |
| | | **(4)** |
| **(b)** | Substitutes $r=0.4$ into $\frac{a}{1-r}=75$ and finds $a$ | M1 |
| | $a=45$ | A1 |
| | | **(2)** |
| | | **(6 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **3(a)(i)** | $a_1=\frac{1}{4}$ | B1 |
| **(ii)** | $a_2=\frac{1}{4}$ | B1 |
| **(iii)** | $a_3=1$ | B1 |
| | | **(3)** |
| **(b)** | $\frac{50}{2}\left[2+49\right]\ (=1275)$ oe | M1A1 |
| | $\sum_{n=1}^{50}\cos^2\left(\frac{n\pi}{3}\right)=34\times\frac{1}{4}+16\times1$ | M1 |
| | $1275+\frac{49}{2}=\frac{2599}{2}$ | A1 |
| | | **(4)** |
| | | **(7 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **1 (a)** | Attempts $u_3=3u_2-2u_1\Rightarrow 4=3u_2-2\times7\Rightarrow u_2=...$ | M1 |
| | $\Rightarrow u_2=6$ | A1 |
| | | **(2)** |
| **(b)** | Attempts $u_4=3u_3-2u_2=3\times4-2\times"6"=\left(0\right)$ | M1 |
| | $\sum_{r=1}^{4}\left(u_r+2r\right)=\left(7+2\times1\right)+\left("6"+2\times2\right)+\left(4+2\times3\right)+\left("0"+2\times4\right)$ | dM1 |
| | $=37$ | A1 |
| | | **(3)** |
| | | **Total 5** |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 6(a) | Integrate to obtain form $k\mathrm{e}^{2x-1}$ | **M1** | any constant $k$, $k \neq 6$ |
| | Obtain correct $\frac{3}{2}\mathrm{e}^{2x-1}$ | **A1** | |
| | Apply limits correctly to $k\mathrm{e}^{2x-1}$ and equate to 120 | **M1** | Allow one slip |
| | Rearrange as far as $a = ...$ | **M1** | |
| | Obtain $a = \frac{1}{2}\ln(80 + \mathrm{e}^{2a-1}) - \frac{1}{2}$ | **A1** | AG – necessary detail needed |
| | | **5** | |
| 6(b) | Use iteration process correctly at least once | **M1** | |
| | Obtain final answer 1.76 | **A1** | Answer required to exactly 3 s.f. |
| | Show sufficient iterations to 5 s.f. to justify answer or show sign change in the interval [1.755, 1.765] | **A1** | |
| | | **3** | |

| Question Number | Scheme | Marks |
|---|---|---|
| **7.(a)** | Attempts to use $4000 = 300 + 11d$ to find '$d$' | M1 |
| | Uses $300 + 3"d"$ | M1 |
| | Wheat production in year 4 is awrt 1310 (to the nearest 10) (tonnes) | A1 |
| | | **(3)** |
| **(b)** | Attempts to use $4000 = 300r^{11}$ to find '$r$' | M1 |
| | Finds $r = (1.266...)$ and MULTIPLIES this by 300 | M1 |
| | Wheat production in year 2 is awrt 380 (to the nearest 10) (tonnes) | A1 |
| | | **(3)** |
| **(c)** | Attempts $\frac{12}{2}\{300 + 4000\}$ or $\frac{300\left("1.266..."^{12} - 1\right)}{"1.266..." - 1}$ | M1 |
| | Finds $\frac{12}{2}\{300 + 4000\} - \frac{300\left("1.266..."^{12} - 1\right)}{"1.266..." - 1} = (25800 - 17935)$ | dM1 |
| | Difference = 7860 but allow 7870 (tonnes) (not AWRT) | A1 |
| | | **(3)** |
| | | **(9 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **10(a)** | $d = \frac{37-15}{11}\left(=2\right)$ | M1 |
| | $u_5 = 15+4\times"2" = ...$ | M1 |
| | Week 5 Sunday run = 23 (km) | A1 |
| | | **(3)** |
| **(b)** | $r^{11} = \frac{37}{15} \Rightarrow r = \sqrt[11]{\frac{37}{15}} = ...$ | M1 |
| | $u_5 = 15\times"1.0855..."^4 = ...$ | M1 |
| | Week 5 Sunday run = awrt 20.8 (km) | A1 |
| | | **(3)** |
| **(c)** | $S_{12} = \frac{12}{2}\left[2\times15+(12-1)\times"2"\right]$ or $\frac{12}{2}\left(15+37\right)$ $\left(=312\right)$ | M1 |
| | $S_{12} = \frac{15(1-"1.08554.."^{12})}{1-"1.08554.."}$ $\left(=294.185..\right)$ | M1 |
| | Difference $= \left(\frac{360-312}{12}\right)$ or $\left(\frac{360-294.185...}{12}\right) = ...$ | dM1 |
| | Either<br>Training model $A$: $x \leqslant 4$ km, Training model $B$: $x \leqslant 5.4\ldots$ km<br>with = or $\leqslant$ | A1 |
| | Training model $A$: $x = 4$ km, Training model $B$: $x = 5$km | A1cso |
| | | **(5)** |
| | | **(11 marks)** |

| Question Number | Scheme | Marks |
|---|---|---|
| **10 (a)** | $y=\frac{9x-x^2}{2\sqrt{x}}=\frac{9}{2}x^{\frac{1}{2}}-\frac{1}{2}x^{\frac{3}{2}} \Rightarrow \quad \frac{\mathrm{d}y}{\mathrm{d}x}=\frac{9}{4}x^{-\frac{1}{2}}-\frac{3}{4}x^{\frac{1}{2}}$ | M1, A1 |
| | Sets $\frac{9}{4}x^{-\frac{1}{2}}-\frac{3}{4}x^{\frac{1}{2}}=0 \Rightarrow x=\frac{9}{4}\times\frac{4}{3} \Rightarrow x=3$ | dM1, A1 |
| | | **(4)** |
| **(b)** | $\int\left\{\frac{9}{2}x^{\frac{1}{2}}-\frac{1}{2}x^{\frac{3}{2}}\right\}\mathrm{d}x=3x^{\frac{3}{2}}-\frac{1}{5}x^{\frac{5}{2}}$ | M1, A1 |
| | Upper limit is 9 | B1 |
| | Area $R=\left[3x^{\frac{3}{2}}-\frac{1}{5}x^{\frac{5}{2}}\right]_1^9=\left(3\times27-\frac{1}{5}\times243\right)-\left(3\times1-\frac{1}{5}\times1\right)$ | dM1 |
| | $=\frac{148}{5}$ | A1 |
| | | **(5)** |
| | | **Total 9** |