12. (a) 150000×1.035^{20} ***(M1)(A1)***

$= \$298468$ ***A1***

Note: Only accept answers to the nearest dollar. Accept $298469.

[3 marks]

(b) attempt to look for a pattern by considering 1 year, 2 years *etc* ***(M1)***
recognising a geometric series with first term P and common ratio 1.02 ***(M1)***

EITHER

$P + 1.02P + \ldots + 1.02^{19}P \left(= P\left(1 + 1.02 + \ldots + 1.02^{19}\right)\right)$ ***A1***

OR

explicitly identify $u_1 = P$, $r = 1.02$ and $n = 20$ (may be seen as S_{20}). ***A1***

THEN

$$S_{20} = \frac{\left(1.02^{20} - 1\right)P}{(1.02 - 1)}$$ ***AG***

[3 marks]

(c) $24.297\ldots P = 298468$ ***(M1)(A1)***
$P = 12284$ ***A1***

Note: Accept answers which round to 12284.

[3 marks]

(d) (i) **METHOD 1**

$Q\left(1.028^n\right) = 5000\left(1 + 1.028 + 1.028^2 + 1.028^3 + \ldots + 1.028^{n-1}\right)$ ***M1A1***

$$Q = \frac{5000\left(1 + 1.028 + 1.028^2 + 1.028^3 + \ldots + 1.028^{n-1}\right)}{1.028^n}$$ ***A1***

$$= \frac{5000}{1.028} + \frac{5000}{1.028^2} + \ldots + \frac{5000}{1.028^n}$$ ***AG***

continued…

Question 12 continued

METHOD 2

the initial value of the first withdrawal is $\frac{5000}{1.028}$ ***A1***

the initial value of the second withdrawal is $\frac{5000}{1.028^2}$ ***R1***

the investment required for these two withdrawals is $\frac{5000}{1.028}+\frac{5000}{1.028^2}$ ***R1***

$Q=\frac{5000}{1.028}+\frac{5000}{1.028^2}+\ldots+\frac{5000}{1.028^n}$ ***AG***

(ii) sum to infinity is $\frac{\frac{5000}{1.028}}{1-\frac{1}{1.028}}$ ***(M1)(A1)***

$=178571.428\ldots$

so minimum amount is $\$178572$ ***A1***

Note: Accept answers which round to $\$178571$ or $\$178572$.

[6 marks]

Total [15 marks]