Exercise 1.1

(a) The required hypotenuse

$= \sqrt{1107^2 + 4920^2}$ — Pythagoras' theorem (A1)

$= 5043 \text{ mm}$

$= 5.043 \times 10^3 \text{ mm}$ — $a = 5.043$ & $k = 3$ (A1)

(b) The required perimeter

$= 1107 + 4920 + 5043$ — The sum of 3 sides (A1)

$= 11070 \text{ mm}$

$= 11000 \text{ mm}$ — Round off to 2 sig. fig.

$= 1.1 \times 10^4 \text{ mm}$ — $a = 1.1$ & $k = 4$ (A1)

(c) The required area

$= \dfrac{(1107)(4920)}{2}$ — $\dfrac{\text{Base length} \times \text{Height}}{2}$ (A1)

$= 2723220 \text{ mm}^2$

$= 2723000 \text{ mm}^2$ — Round off to 4 sig. fig.

$= 2.723 \times 10^6 \text{ mm}^2$ — $a = 2.723$ & $k = 6$ (A1)

Exercise 1.2

(a) The exact volume

$= (2)(0.8)(0.8)$ — $V = lwh$ (M1)

$= 1.28 \text{ m}^3$ — (A1)

(b) The approximated value

$= (2.2)(1)(0.7)$

$= 1.54 \text{ m}^3$ — 1.54 (A1)

The percentage error

$= \left| \dfrac{1.54 - 1.28}{1.28} \right| \times 100\%$ — $\left| \dfrac{v_A - v_E}{v_E} \right| \times 100\%$ (M1)

$= 20.3125\%$

$= 20.3\%$ — (A1)

Exercise 1.3

(a) $u_1 = 10$ (A1)

(b) (i) $u_2 = (5+1)(2)$

$u_2 = 12$

$u_3 = (5+1+1)(2)$ $u_2 = (6)(2)$ & $u_3 = (7)(2)$ (A1)

$u_3 = 14$ (AG)

(ii) $d = 2$ (A1)

(c) (i) $u_n = (20)(2)$ Set up an equation

$\therefore 10 + (n-1)(2) = 40$ Correct equation (A1)

$2(n-1) = 30$

$n - 1 = 15$

$n = 16$

Thus, Fatima has collected 16 apples. (A1)

(ii) The total distance

$= S_{16}$

$= \frac{16}{2}[u_1 + u_{16}]$ $S_n = \frac{n}{2}[u_1 + u_n]$ (M1)

$= \frac{16}{2}(10 + 40)$ $u_1 = 10$ & $u_{16} = 40$ (A1)

$= 400$ metres (A1)

(d) (i) $S_n = 491$

$\therefore \frac{n}{2}\left[2(10)+(n-1)(2)\right] = 491$ Correct equation (A1)

$\frac{n}{2}(20+2n-2) = 491$

$\frac{n(2n+18)}{2} - 491 = 0$

By considering the graph of $y = \frac{n(2n+18)}{2} - 491$, the horizontal intercepts are -27.11084 (*Rejected*) and 18.110838. GDC approach (M1)

Thus, the total number of apples that Akash has collected is 18. (A1)

(ii) The required distance

$= 491 - S_{18}$ Subtracted by S_{18} (M1)

$= 491 - \frac{18}{2}\left[2(10)+(18-1)(2)\right]$ $u_1 = 10$ & $d = 2$ (A1)

$= 5$ metres (A1)

Exercise 1.4

(a) The café's profit

$= u_{10}$ — 10th term (M1)

$= u_1 \times r^{10-1}$

$= 1200 \times 1.08^9$ — $u_1 = 1200$ & $r = 1.08$ (A1)

$= \$2398.805553$

$= \$2400$ — (A1)

(b) (i) S_n

$= \dfrac{u_1(1-r^n)}{1-r}$ — $S_n = \dfrac{u_1(1-r^n)}{1-r}$ (M1)

$= \dfrac{1200(1-1.08^n)}{1-1.08}$ — $u_1 = 1200$ & $r = 1.08$ (A1)

$= -15000(1-1.08^n)$ — (AG)

(ii) The total profit

$= S_{11}$

$= -15000(1-1.08^{11})$ — $n = 11$ (M1)

$= \$19974.58496$

$= \$20000$ — (A1)

(c) The dessert shop's profit

$= v_7$ — 7th term (M1)

$= 1200 + (7-1)(180)$ — $v_1 = 1200$ & $d = 180$ (A1)

$= \$2280$ — (A1)

(d) $S_m > \dfrac{m}{2}\left[2u_1 + (m-1)d\right]$ — Set up an inequality

$\therefore -15000(1-1.08^m) > \dfrac{m}{2}\left[2(1200) + (m-1)(180)\right]$ — Correct inequality (A1)

$-15000(1-1.08^m) - \dfrac{m}{2}\left[2(1200) + (m-1)(180)\right] > 0$

By considering the graph of

$y = -15000(1-1.08^m) - \dfrac{m}{2}\left[2(1200) + (m-1)(180)\right]$,

the graph is above the horizontal axis when

$m < 1$ (*Rejected*) or $m > 23.044309$. — GDC approach (M1)

$\therefore m = 24$ — (A1)

Exercise 1.5

(a) (i) $\begin{cases} 8x+7y+5z=41 \\ 6x+4y+10z=22 \\ 13x+7y=66 \end{cases}$ (A1)(A1)(A1)

(ii) $x=4$, $y=2$ and $z=-1$ (A1)(A1)(A1)

(b) A team drops one point for losing a game. (A1)

Exercise 1.6

(a) (i) By financial solver:

$N(n)=16$
$I\%=8$
$PV=-10000$
$PMT(Pmt)=0$
$FV=?$
$P/Y(PpY)=4$
$C/Y(CpY)=4$
$PMT(PmtAt):END$

GDC approach (M1)(A1)

$FV=13727.85705$

Thus, the amount after 4 years is $\$13700$. (A1)

(ii) The interest

$=13727.85705-10000$ $I=FV-PV$ (M1)

$=\$3727.857051$

$=\$3730$ (A1)

(b) By financial solver:

$N(n)=?$
$I\%=8$
$PV=-10000$
$PMT(Pmt)=0$
$FV=25000$
$P/Y(PpY)=4$
$C/Y(CpY)=4$
$PMT(PmtAt):END$

GDC approach (M1)(A1)

$N=46.27116989$

The number of years

$=\frac{46.27116989}{4}$

$=11.56779247$ 11.56779247 (A1)

Thus, the required year is 2036. (A1)

(c) (i) 5% (A1)

(ii) By financial solver:

$N(n) = 16$
$I\% = 5$
$PV = -10000$
$PMT(Pmt) = 0$
$FV = ?$
$P/Y(PpY) = 4$
$C/Y(CpY) = 4$
$PMT(PmtAt) : END$

GDC approach (M1)(A1)

$FV = 12198.89548$

Thus, the real amount after 4 years is 12200. (A1)

Exercise 1.7

(a) (i) By financial solver:

$N(n) = 270$
$I\% = 3.3$
$PV = 300000$
$PMT(Pmt) = ?$
$FV = 0$
$P/Y(PpY) = 12$
$C/Y(CpY) = 12$
$PMT(PmtAt) : END$

GDC approach (M1)(A1)

$PMT = -1575.653923$

Thus, the amount of monthly payment is

1580 USD. (A1)

(ii) The total amount

$= (1575.653923)(270)$ $PMT \times N$ (A1)

$= 425426.5592$ USD

$= 425000$ USD (A1)

(iii) The amount of interest

$= 425426.5592 - 300000$ $I = FV - PV$ (M1)

$= 125426.5592$ USD

$= 125000$ USD (A1)

(b) (i) By financial solver:

$N(n) = ?$
$I\% = 3.3$
$PV = 300000$
$PMT(Pmt) = -2250$
$FV = 0$
$P/Y(PpY) = 12$
$C/Y(CpY) = 12$
$PMT(PmtAt) : END$

GDC approach (M1)(A1)

$N = 166.3222392$

Thus, the required number of months is

167. (A1)

(ii) The exact total amount

$= (167)(2250)$ $PMT \times N$ (A1)

$= 375750$ USD (A1)

(iii) The amount of interest

$= 375750 - 300000$ $I = FV - PV$ (M1)

$= 75750$ USD (A1)

(c) The amount of monthly payment in option 1 is less than that in option 2. Comparing monthly payment (R1)

Thus, the option 1 is better. (A1)