1) $S_n = a + a+d + \dots + a+(n-2)d + a+(n-1)d$

$S_n = a+(n-1)d + a+(n-2)d + \dots + a+d + a$

$2S_n = 2a+(n-1)d + 2a+(n-1)d + \dots + 2a+(n-1)d + 2a+(n-1)d$

$2S_n = n(2a+(n-1)d)$

$S_n = \frac{n}{2}(2a+(n-1)d)$

2) $u_5 = 5 \quad u_8 = -16$

$a + 4d = 5$

$a + 7d = -16$

$3d = -21$

$d = -7$

$a + 4(-7) = 5$

$a - 28 = 5$

$a = 33$

3a+b) $u_3 = -4 \quad S_8 = 22$

$a + 2d = -4 \qquad 4(2a + 7d) = 22$

$2a + 4d = -8$

$2a + 7d = \frac{11}{2}$

$3d = 27/2$

$d = \frac{9}{2}$

$a + 2(\frac{9}{2}) = -4$

$a + 9 = -4$

$a = -13$

3c $\frac{n}{2}(2a + (n-1)d) < 200$

$\frac{n}{2}\left(2(-13) + (n-1)\frac{9}{2}\right) < 200$

$\frac{n}{2}\left(-26 + \frac{9}{2}n - \frac{9}{2}\right) < 200$

$\frac{n}{2}\left(\frac{9}{2}n - \frac{61}{2}\right) < 200$

$\frac{9}{4}n^2 - \frac{61}{4}n < 200$

$9n^2 - 61n < 800$

$9n^2 - 61n - 800 < 0$

$a = 9 \quad b = -61 \quad c = -800$

$$n = \frac{-(-61) \pm \sqrt{(-61)^2 - 4(9)(-800)}}{2(9)}$$

$n = 13.4 \quad , \quad -6.6$

13

4a) $a = 2.20 \qquad d = 0.20$

$$u_{100} = 2.20 + 99(0.20)$$
$$= \underline{\underline{£22}}$$

b) $$S_n = \frac{n}{2}(a + l)$$

$$S_{100} = \frac{100}{2}(2.20 + 22)$$

$$= \underline{\underline{£1210}}$$

5a) $$u_2 - u_1 = (2k + 4) - (k + 3)$$

$$= k + 1$$

$$u_3 - u_2 = (4k - 2) - (2k + 4)$$

$$= 2k - 6$$

$$k + 1 = 2k - 6$$
$$1 = k - 6$$
$$\underline{\underline{k = 7}}$$

b) 10, 18, 26

$a = 10 \qquad d = 8$

$$S_n = \frac{n}{2}(2a + (n-1)d)$$
$$S_{20} = \frac{20}{2}(2(10) + 19(8))$$

$$= 10(20 + 152)$$
$$= \underline{\underline{1720}}$$

6a) $a = 100$ $\quad d = 4$

$$u_n = a + (n-1)d$$

$$180 = 100 + (n-1)4$$

$$80 = 4(n-1)$$

$$20 = n-1$$

$$\underline{\underline{n = 21}}$$

b) $$S_n = \frac{n}{2}(2a + (n-1)d)$$

$$S_{21} = \frac{21}{2}(2(100) + 20(4))$$

$$= \frac{21}{2}(280)$$

$$= 2940 \quad \text{(in the first 21 weeks)}$$

31 weeks left : $31 \times 180 = 5580$

$$2940 + 5580 = \underline{\underline{8520}}$$

7/ BERTIE: $a = 300$

$d = 40$

CHARLOTTE: $a = 500$

$d = 20$

$$S_n = \frac{n}{2}(2a + (n-1)d)$$

$$\frac{n}{2}(2(300) + (n-1)40) = \frac{n}{2}(2(500) + (n-1)20)$$

$$n(600 + 40n - 40) = n(1000 + 20n - 20)$$

$$n(40n + 560) = n(20n + 980)$$

$$40n^2 + 560n = 20n^2 + 980n$$

$$20n^2 - 420n = 0$$

$$n^2 - 21n = 0$$

$$n(n - 21) = 0$$

$n = 0$ $n = 21$

21 months