1. $.58x = .60y$

$y + 20 = x$

$.58y + .58 \cdot 20 = .60y$

$.02y = \frac{58}{5}$

$y = \frac{58}{5} \cdot 50 = 580$

$580 \cdot \frac{2}{5} = 116 \cdot 2 = 232 \Rightarrow 232 + 20 = 252$

2. $r$ : $\frac{\text{miles}}{\text{minute}}$ $\quad j$ : miles/minute

$j = \frac{3}{4} \cdot r$

$r \cdot (t - 5 \cdot \cancel{50}^{49}) = \frac{3}{4} r (t - 5 \cdot 2\cancel{5}^{4})$

$rt - \cancel{250}^{245} r = \frac{3}{4} rt - \frac{3}{4} \cdot \cancel{125}^{120} r$

$\frac{1}{4} rt = \cancel{250}^{245} r - \frac{3}{4} \cdot \cancel{125}^{120} r$

$rt = \cancel{1000}^{980} r - \cancel{375}^{360} r = \cancel{625}^{620} r$

$t = 625$ $\quad t = 620$

3. $t = 0$

$t = 2$ $A = 12$, $B = 12 + 8 = 20$

$t = 4$ $A = 24$, $B = 24 + 16 = 40$, $C = 0$

$6t \quad 10(t-2) \quad \cancel{14}^{8}(t-4)$ My intuition about order = correct

$6t = \frac{10(t-2) + \cancel{14}^{8}(t-4)}{2}$

$6t = \frac{10t + \cancel{14}^{8} t - 20 - \cancel{56}^{32}}{2}$

$6t = \frac{\cancel{24t}^{18t} - \cancel{76}^{52}}{2}$

$6t = A$

$\cancel{38}^{52} = \cancel{6t}$

$t = \cancel{\frac{38}{6}}^{\frac{26}{3}} \rightarrow \cancel{\frac{38}{6}}^{\frac{26}{3}} \cdot 6 = \cancel{38}^{52}$ ft

4. $\frac{x}{y} = \frac{1}{2}$ $\quad \frac{x+3}{y+4} > .503$

$x + 3 > .503(y + \cancel{1}^{4})$

$x + 3 > .503(2x + \cancel{1}^{4})$

$x + 3 > 1.006x + \cancel{.503}^{2.012}$

$\cancel{2.497}^{.988} > .006x$

$x < \frac{\cancel{2.497}^{.988}}{.006}$

$\left\lfloor \frac{988}{6} \right\rfloor = 164$

$\cancel{\left\lfloor \frac{2497}{6} \right\rfloor = 416}$

$x = \cancel{416}$ 164

5. $\dfrac{23\cdot 3 + 13\cdot 5 + 14\cdot 2 + 15 + ax}{31+x} = 6$

$69 + 65 + 28 + 15 + ax = 186 + 6x$

$134 + 43 = 177 \quad (a-6)x = 9$

$x = k - 52$

$(175-21)\cdot 6 + 5 + 14$

$(154)\cdot 6 + 19 = 924 + 19 = 943$

$\dfrac{5+14+69+a(k-52)}{44+(k-52)} = 5$

$88 + a(k-52) = 5(44-52+k)$

$(a-6)(k-52) = 9$

$88 + 6(k-52) = 5(k-8) - 9$

$88 + 6k - 312 = 5k - 49$

$k = 312 - 137 = 175$

6. $6(x_1+x_2+x_3+x_4+x_5) = 96+48+24+12+6$

$x_1+x_2+x_3+x_4+x_5 = 16+8+4+2+1$

$= 31$

Then $x_5 = 96 - 31 = 65$

Then $x_4 = 48 - 31 = 17$

$\Rightarrow$ So $3x_4 + 2x_5 = 51 + 130 = 181$

7. $\dfrac{x}{k} < \dfrac{160}{300} = \dfrac{8}{15}$ $\quad \dfrac{y}{500-k} < \dfrac{140}{200} = \dfrac{7}{10}$

$x + y < \dfrac{8}{15}k + \dfrac{7}{10}(500-k)$

$x + y < 350 - \dfrac{21k + 16k}{30} = 350 - \dfrac{1}{6}k \Rightarrow x + y \le 349$

Thus $349 + 500 = 849$

OR

Highest = max points on second day

Then 1st day $= \frac{1}{2}$

So $\dfrac{y}{498} < \dfrac{7}{10}$, $10y < 3486$, $y < 348.6$

$\hookrightarrow y = 348$

So $348 + 1 + 500 = 849$

8. $100\cdot a + 10b + c = 2(49\cdot a + 7\cdot b + c)$

base represented: $c + 4b = 2a$

$c + 4b - 2a = 0$

$\begin{matrix} 0 & 3 & 6 \\ c & b & a \end{matrix} \Rightarrow 0 + 7\cdot 3 + 49\cdot 6 = 315$

9. $1000\cdot x = 1000$ $\quad \cancel{1 + \frac{9}{10} + \frac{4}{5} + (800+y)\cdot x = 4}$

$900\cdot x = \cancel{\frac{9}{10}}\,1000$ $\quad \cancel{(800+y)\cdot \frac{1}{1000} = 3 - \frac{17}{10} = \frac{13}{10}}$

$x = \dfrac{1000}{900}$

$\cancel{(800+y) = 1300}$

$y = 500$

$1 + \dfrac{10}{9} + \dfrac{10}{8} + \dfrac{1000}{(800+y)} = 4$

$\dfrac{1000}{(800+x)} = 4 - 1 - \dfrac{10}{9} - \dfrac{10}{8}$

$= \dfrac{3\cdot 72 - 80 - 90}{72}$

$= \dfrac{144 - 98}{72}$

$= \dfrac{46}{72} = \dfrac{23}{36}$

10. $\frac{3}{5} \cdot 70 = 42$ from May

$\frac{3}{42} = \frac{1}{14}$ of May pop. tagged (60 fish tagged)

Thus $14 \cdot 60 =$ 840 fish in May

$36000 = 23(800+x)$

$1566 - 800 = 766 = x$

11. $x+y+z = n$

$\frac{3}{4}x + \frac{3}{8}y + \frac{11}{24}z = \frac{1}{2}(x+y+z) \Rightarrow 18x + 9y + 11z = 12(x+y+z) \Rightarrow z = 6x - 3y$

$\frac{1}{8}x + \frac{1}{4}y + \frac{11}{24}z = \frac{1}{3}(x+y+z) \Rightarrow 3x + 6y + 11z = 8(x+y+z) \Rightarrow 3x+6y+11(6x-3y) = 8(x+y+z)$

$\frac{1}{8}x + \frac{3}{8}y + \frac{1}{12}z = \frac{1}{6}(x+y+z) \Rightarrow 3x + 9y + 2z = 4(x+y+z)$

$3x + 6y + 66x - 33y = 8x + 8y + 8(6x-3y)$

$69x - 27y = 8x + 8y + 48x - 24y$

$13x = 11y$

$x+y+z = x + \frac{13}{11}x + 6x - 3\left(\frac{13}{11}x\right)$

$= 7x - 2 \cdot \frac{13}{11}x = \frac{77-26}{11}x = \frac{51}{11}x$

x must be multiple of 11, but also of 8 (1/8 of x = whole)

Thus $x = 11 \cdot 8 \Rightarrow \frac{51}{11} \cdot 11 \cdot 8 = 408$

12. $28 + 3xyz = x^3 + y^3 + z^3$

$x^3 = 2 + xyz$

$x^3y^3z^3 = (2+xyz)(6+xyz)(20+xyz)$

$= (12 + 8xyz + x^2y^2z^2)(20 + xyz)$

$= 240 + 160xyz + 20x^2y^2z^2 + 12xyz + 8x^2y^2z^2 + x^3y^3z^3)$

$0 = 240 + 172xyz + 28x^2y^2z^2$

$0 = 60 + 43xyz + 7x^2y^2z^2$

$7 \quad 15$

$1 \quad 4$

$= (7xyz + 15)(xyz + 4)$

$xyz = -4, -\frac{15}{7}$

$28 + 3xyz = x^3 + y^3 + z^3$

$28 - 3 \cdot \frac{15}{7} = x^3 + y^3 + z^3$

$x^3 + y^3 + z^3 = 28 - \frac{45}{7} = \frac{196 - 45}{7} = \frac{151}{7} \Rightarrow 158$

13.

$$\begin{array}{cc} 6w & c\,19 \\ \| & \| \\ 2w & c\,18 \end{array}$$

$w \le 3$ since $w \ge 4$ gives us diff $c$ for same $s$.

Also, $c+w \not\le 25$, since also gives us redundancy

So $c+w \ge 26$

Then smallest $\Rightarrow$ $c = 23$, $c = 3$ $\quad s = 30 - 3 + 23 \cdot 4 = 27 + 92 = 119$

14. Bob time $= \dfrac{n}{b+v}$ $\quad$ Al $= \dfrac{n}{3b-v}$

$75 = b\left(\dfrac{n}{b+v}\right)$

$150 = 3b\left(\dfrac{n}{3b-v}\right)$

$\dfrac{2bn}{b+v} = \dfrac{3bn}{3b-v}$

$6b^2n - 2bnv = 3b^2n + 3bnv$

$3b^2\cancel{n} = 5\cancel{b}\cancel{n}v$

$3b = 5v$

$\dfrac{5vn}{4v} = 150$

$n = 150 \cdot \dfrac{4}{5}$

$= 120$

15. $ax^4 + by^4 = 42$

$(ax^4 + by^4)(x+y) = 42(x+y)$

$(ax^5 + bxy^4 + ax^4y + by^5) = 42(x+y)$

$ax^5 + by^5 + xy(by^3 + ax^3) = 42(x+y)$

$ax^5 + by^5 + xy(16) = 42(x+y)$ $\Longrightarrow$ $ax^5 + by^5 + -38 \cdot 16 = 42 \cdot -14$

$ax^5 + by^5 = 20$

$ax^3 + by^3 + xy(ax + by) = 7(x+y)$

$16 + xy(3) = 7(x+y)$

$ax^4 + by^4 + xy(ax^2 + by^2) = 16(x+y)$

$42 + xy(7) = 16(x+y)$

$xy + 10 = 2(x+y)$

$xy = 2(x+y) - 10$

$6(x+y) - 30 + 16 = 7(x+y)$

$(x+y) = -14$

$xy = -38$