1. $2a+b(a+1)^2 = 2(2)+5(2+1)^2$

$= 4+5\times 3^2 = 49$

2. $q\sqrt{p^2+4q}-p = (-2)\sqrt{(-3)^2+4(-2)}-(-3)$

$= (-2)\sqrt{9-8}+3 = (-2)(1)+3 = 1$

3.(i) $x-y = (3)-(-2) = 3+2 = 5$

(ii) $x^2-y^2 = (3)^2-(-2)^2 = 9-4 = 5$

(iii) $x^3-y^3 = (3)^3-(-2)^3 = 27-(-8) = 35$

(iv) $(x-y)^3 = ((3)-(-2))^3 = (3+2)^3 = 5^3 = 125$

4. (i) $100\pi^5 = 30601\cdot 96848 = 30600$ (3 s. f.)

(ii) $1+2\sqrt{3} = 4\cdot 4641 = 4\cdot 46$ (3 s.f.)

(iii) $\dfrac{\pi+1}{\pi-1} = \dfrac{4\cdot 1416}{2\cdot 1416} = 1\cdot 93$ (3 s. f.)

(iv) $\dfrac{\sqrt{2}}{\sqrt{507}} = 0\cdot 062807 = 0\cdot 0628$ (3 s. f.)

(v) $\sqrt{\dfrac{2}{507}} = \sqrt{0\cdot 0039448} = 0\cdot 0628$ (3 s. f.)

5. (i) $\dfrac{1}{x} = \dfrac{1}{2\cdot 31} = 0\cdot 43$ (2 s. f.)

(ii) $x-\sqrt{x} = 2\cdot 31-\sqrt{2\cdot 31} = 0\cdot 79$ (2 s. f.)

(iii) $\dfrac{1}{x+\sqrt{x}} = \dfrac{1}{2\cdot 31+\sqrt{2.31}}$

$= \dfrac{1}{3\cdot 8299} = 0\cdot 26$ (2 s. f.)

(iv) $\dfrac{1}{x}+\dfrac{1}{\sqrt{x}} = \dfrac{1}{2\cdot 31}+\dfrac{1}{\sqrt{2\cdot 31}}$

$= 0\cdot 4329+0\cdot 6580 = 1\cdot 1$ (2 s.f.)

6. $E = p+k \Rightarrow E-p = k$

7. $F = ma \Rightarrow \frac{F}{a} = m$

8. $ym = x + c \Rightarrow y - c = mx$

$\Rightarrow \frac{y-c}{x} = m$

9. $E = mc^2 \Rightarrow \frac{E}{m} = c^2$

$\Rightarrow \pm\sqrt{\frac{E}{m}} = c$

10. (i) $E = \frac{V}{R} \Rightarrow ER = V$

(ii) $E = \frac{V}{R} \Rightarrow ER = V \Rightarrow R = \frac{V}{E}$

11. $t = a + (n-1)d$

$t - a = (n-1)d$

$\frac{t-a}{n-1} = d$

12. (i) $v^2 = u^2 + 2as$

$v^2 - 2as = u^2$

$\pm\sqrt{v^2 - 2as} = u$

(ii) $v^2 = u^2 + 2as$

$v^2 - u^2 = 2as$

$\frac{v^2 - u^2}{2a} = s$

13. $t = c + k(v+3)$

$t - c = k(v+3)$

$\frac{t-c}{k} = v + 3$

$\frac{t-c}{k} - 3 = v = \frac{t-c-3k}{k}$

14. $s = ut + \frac{1}{2}at^2$

$$s - ut = \frac{1}{2}at^2$$
$$2(s - ut) = at^2$$
$$\frac{2(s-ut)}{t^2} = a$$

15. $z = \frac{p}{2s+q}$

$$2sz + qz = p$$
$$2sz = p - qz$$
$$s = \frac{p - qz}{2z}$$

16. $s = \frac{a}{1-r}$

$$s - sr = a$$
$$s - a = sr$$
$$\frac{s-a}{s} = r$$

17. (i) $A = 4\pi r^2 \Rightarrow \frac{A}{4\pi} = r^2 \Rightarrow \pm\sqrt{\frac{A}{4\pi}} = r$

(ii) $V = \frac{4}{3}\pi r^3 \Rightarrow \frac{3V}{4\pi} = r^3 \Rightarrow \sqrt[3]{\frac{3V}{4\pi}} = r$

18. (i) $x = \sqrt{y+z} \Rightarrow x^2 = y + z \Rightarrow x^2 - z = y$

(ii) $x = \sqrt{y} + z \Rightarrow x - z = \sqrt{y} \Rightarrow (x-z)^2 = y$

19. (i) $k = 2t + at = t(2+a)$

$$\Rightarrow \frac{k}{2+a} = t$$

(ii) $s = 2xl + xy = x(2l + y)$

$$\frac{s}{2l+y} = x$$

(iii) $A = \pi rl + 2\pi rh = r\pi(l + 2h)$

$$\Rightarrow \frac{A}{\pi(l+2h)} = r$$

(iv) $E = mgh + \frac{1}{2}mv^2$

$2E = 2mgh + mv^2 = m(2gh + v^2)$

$\Rightarrow \frac{2E}{(2gh + v^2)} = m$

(v) $x = \frac{t-1}{t} \Rightarrow xt = t - 1$

$\Rightarrow xt - t = -1 \Rightarrow t(x-1) = -1$

$\Rightarrow t = -\frac{1}{x-1}$

20. (i) $t = 2\pi\sqrt{\frac{l}{g}}$

$t^2 = \left(2\pi\sqrt{\frac{l}{g}}\right)^2 = 4\pi^2\frac{l}{g}$

$\Rightarrow t^2 g = 4\pi^2 l \Rightarrow g = \frac{4\pi^2 l}{t^2}$

$t = 1,\ l = 0\cdot 25$

$\Rightarrow g = \frac{4\pi^2 l}{t^2} = \frac{4\pi^2 \times 0\cdot 25}{1^2} = 9\cdot 9$

(ii) $v = \frac{1}{3}\pi h\left\{R^2 + Rr + r^2\right\}$

$\Rightarrow 3v = \pi h\left\{R^2 + Rr + r^2\right\}$

$\Rightarrow \frac{3v}{\pi\left\{R^2 + Rr + r^2\right\}} = h$

$v = 33,\ R = 2,\ r = 1, \pi = \frac{22}{7}$

$\Rightarrow h = \frac{3v}{\pi\left\{R^2 + Rr + r^2\right\}} = \frac{3\times 33}{\frac{22}{7}\left\{2^2 + 2\times 1 + 1^2\right\}}$

$= \frac{99}{\frac{22}{\cancel{7}}\left\{\cancel{7}\right\}} = 4\cdot 5$

(iii)

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

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

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

$$\frac{2s}{n}-2a=(n-1)d=\frac{2s-2an}{n}=\frac{2(s-an)}{n}$$

$$d=\frac{2(s-an)}{n(n-1)}$$

$$s=6600,\ a=-33,\ n=100$$

$$d=\frac{2(s-an)}{n(n-1)}=\frac{2(6600-(-33)\times100)}{100(100-1)}$$

$$=\frac{2(9900)}{100\times99}=2$$

(iv) $$A=P\left(1+\frac{r}{100}\right)^3\Rightarrow\frac{A}{P}=\left(1+\frac{r}{100}\right)^3$$

$$\Rightarrow\sqrt[3]{\frac{A}{P}}=1+\frac{r}{100}\Rightarrow\sqrt[3]{\frac{A}{P}}-1=\frac{r}{100}$$

$$\Rightarrow100\left(\sqrt[3]{\frac{A}{P}}-1\right)=r$$

$$P=4500,\ A=6000$$

$$r=100\left(\sqrt[3]{\frac{A}{P}}-1\right)=100\left(\sqrt[3]{\frac{6000}{4500}}-1\right)$$

$$=100(1\cdot1006-1)=10$$

(v) $$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}\Rightarrow\frac{1}{f}-\frac{1}{v}=\frac{1}{u}\Rightarrow\frac{v-f}{fv}=\frac{1}{u}$$

$$\Rightarrow\frac{fv}{v-f}=u$$

$$f=2,\ v=6$$

$$\frac{fv}{v-f}=u=\frac{2\times6}{6-2}=\frac{12}{4}=3$$

21.(i) $$y=\sqrt{\frac{ax^2}{1-r}}\Rightarrow y^2=\frac{ax^2}{1-r}\Rightarrow y^2(1-r)=ax^2$$

$$\Rightarrow\frac{y^2(1-r)}{a}=x^2\Rightarrow\sqrt{\frac{y^2(1-r)}{a}}=x$$

(ii) $y = 1\cdot5,\ r = 0\cdot8,\ a = 0\cdot05$

$$\Rightarrow \sqrt{\frac{y^2(1-r)}{a}} = x = \sqrt{\frac{(1\cdot5)^2(1-(0\cdot8))}{(0\cdot05)}} = \sqrt{\frac{2\cdot25(0\cdot2)}{0\cdot05}}$$

$$= \sqrt{\frac{0\cdot45}{0\cdot05}} = \sqrt{9} = 3$$

22. $x = \dfrac{2t+1}{t-3} \Rightarrow x(t-3) = 2t+1$

$$\Rightarrow xt - 3x = 2t+1 \Rightarrow xt - 2t = 1+3x$$

$$\Rightarrow t(x-2) = 1+3x \Rightarrow t = \frac{1+3x}{x-2}$$

23.

$$x = \frac{t^3+1}{t^3-3} \Rightarrow x(t^3-3) = t^3+1$$

$$\Rightarrow xt^3 - 3x = t^3+1 \Rightarrow xt^3 - t^3 = 1+3x$$

$$\Rightarrow t^3(x-1) = 1+3x \Rightarrow t^3 = \frac{1+3x}{x-1}$$

$$\Rightarrow t = \sqrt[3]{\frac{1+3x}{x-1}}$$

$$x = 2\cdot124 \Rightarrow t = \sqrt[3]{\frac{1+3(2\cdot124)}{(2\cdot124)-1}} = \sqrt[3]{\frac{7\cdot372}{1\cdot124}}$$

$$= \sqrt[3]{6\cdot5587} = 1\cdot87$$

24. (i) $a + y = 2x \Rightarrow a = 2x - y$

$$2b - 2y = 5x \Rightarrow 10b - 10y = 25x \Rightarrow 10b = 25x + 10y$$

Thus, $a + 10b = 2x - y + 25x + 10y = 27x + 9y$

(ii) $a + 10b = 27x + 9y$

$$= 9(3x + y) = 9(10)$$

$$= 90$$

25. $x = 7a + 4b + 1$

$$\underline{2y = 10a - 4b + 6}$$

$$x + 2y = 17a + 7$$

$$\Rightarrow 2y = 17a - x + 7$$

$$\Rightarrow y = \frac{17a - x + 7}{2}$$