Answer Key

1. (a) $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \ldots\ldots\ldots\ldots \infty}}}$

On squaring,

$x^2 = 6 + \sqrt{6 + \sqrt{6 + \ldots\ldots\ldots\ldots \infty}}$

$x^2 = 6 + x$

$x^2 - x - 6 = 0$

$x^2 - 3x + 2x - 6 = 0$

$x(x-3) + 2(x-3) = 0$

$(x-3)(x+2) = 0$

$x = 3$ because $x \neq -2$

2. (a) $x + \frac{1}{x} = 3$

On squaring,

$\left(x + \frac{1}{x}\right)^2 = 9$

$\Rightarrow x^2 + \frac{1}{x^2} = 9 - 2 = 7$

Again, $\left(x + \frac{1}{x}\right)^3 = 27$

$\Rightarrow x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = 27$

$\Rightarrow x^3 + \frac{1}{x^3} = 27 - 3 \times 3 = 18$

$\therefore \left(x^2 + \frac{1}{x^2}\right)\left(x^3 + \frac{1}{x^3}\right)$

$= 7 \times 18$

$\Rightarrow x^5 + \frac{1}{x^5} + \left(x + \frac{1}{x}\right) = 126$

$\Rightarrow x^5 + \frac{1}{x^5} = 126 - 3 = 123$

3. (b) If $a + b + c + 0$

then $a^3 + b^3 + c^3 - 3abc = 0$

4. (a) $a^3 + b^3 + c^3 - 3abc$

$= (a + b + c)$

$(a^2 + b^2 + c^2 - ab - bc - ac)$

$= \frac{1}{2}(a + b + c)(2a^2 + 2b^2 +$

$2c^2 - 2ab - 2bc - 2ac)$

$= \frac{1}{2}(a + b + c)[(a-b)^2 + (b-c)^2 + (c-a)^2]$

$\frac{a^3 + b^3 + c^3 - 3abc}{a + b + c}$

$= \frac{1}{2}\left[(a-b)^2 + (b-c)^2 + (c-a)^2\right]$

$= \frac{1}{2}(9 + 25 + 1)$

$= \frac{35}{2} = 17.5$

5. (d) $1^2 + 2^2 + 3^2 + \ldots\ldots\ldots\ldots + n^2$

$\therefore = \frac{n(n+1)(2n+1)}{6}$

Required average

$= \frac{(n + 1(2n+1)}{6}$

$= \frac{(10+1)(2 \times 10 + 1)}{6}$

$= \frac{11 \times 21}{6} = \frac{77}{2} = 38.5$

6. (c) $2(a^2 + b^2)$

$= (a+b)^2 + (a-b)^2$

$= (6)^2 + (2)^2$

$= 36 + 4 = 40$

7. (b) $\sqrt{2x} \times \frac{5}{100} = 0.01$

$\Rightarrow \sqrt{2x} \times 5 = 0.01 \times 100 = 1$

On squaring,

$2x \times 25 = 1$

$\Rightarrow x = \frac{1}{50} = 0.02$

8. (b) $\sqrt{\frac{x-a}{x-b}} - \sqrt{\frac{x-b}{x-a}} = \frac{b}{x} - \frac{a}{x}$

$\Rightarrow \sqrt{\frac{(x-a)(x-a)}{(x-b)(x-a)}} - \sqrt{\frac{(x-b)(x-b)}{(x-a)(x-b)}}$

$= \frac{b-a}{x}$

$\Rightarrow \frac{x-a}{\sqrt{(x-b)(x-a)}} - \frac{x-b}{\sqrt{(x-a)(x-b)}}$

$= \frac{b-a}{x}$

$\Rightarrow \frac{x-a-x+b}{\sqrt{(x-b)(x-a)}} = \frac{b-a}{x}$

$\Rightarrow \frac{b-a}{\sqrt{(x-b)(x-a)}} = \frac{b-a}{x}$

$\Rightarrow x = \sqrt{(x-b)(x-a)}$

On squaring,

$x^2 = (x-b)(x-a)$

$\Rightarrow x^2 = x^2 - ax - bx + ab$

$\Rightarrow ax + bx = ab$

$\Rightarrow x(a+b) = ab \Rightarrow x = \frac{ab}{a+b}$

9. (b) $x = \frac{2\sqrt{24}}{\sqrt{3}+\sqrt{2}}$

$\Rightarrow x = \frac{2\sqrt{3 \times 8}}{\sqrt{3}+\sqrt{2}} = \frac{2\sqrt{3} \times \sqrt{8}}{\sqrt{3}+\sqrt{2}}$

$\Rightarrow \frac{x}{\sqrt{8}} = \frac{2\sqrt{3}}{\sqrt{3}+\sqrt{2}}$

$\Rightarrow \frac{x+\sqrt{8}}{x-\sqrt{8}} = \frac{2\sqrt{3}+\sqrt{3}+\sqrt{2}}{2\sqrt{3}-\sqrt{3}-\sqrt{2}}$

(By componendo and dividendo)

$= \frac{3\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

Again,

$\frac{x}{\sqrt{12}} = \frac{2\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

$\Rightarrow \frac{x+\sqrt{12}}{x-\sqrt{12}}$

$= \frac{2\sqrt{2}+\sqrt{3}+\sqrt{2}}{2\sqrt{2}-\sqrt{3}-\sqrt{2}} = \frac{\sqrt{3}+3\sqrt{2}}{\sqrt{2}-\sqrt{3}}$

$\therefore \frac{x+\sqrt{8}}{x-\sqrt{8}} + \frac{x+\sqrt{12}}{x-\sqrt{12}}$

$\frac{3\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} + \frac{\sqrt{3}+3\sqrt{2}}{\sqrt{2}-\sqrt{3}}$

$\frac{3\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}} + \frac{\sqrt{3}+3\sqrt{2}}{\sqrt{2}-\sqrt{2}}$

$= \frac{3\sqrt{3}+\sqrt{2}-\sqrt{3}-3\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

$\frac{2\sqrt{3}-2\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

$= \frac{2(\sqrt{3}-\sqrt{2})}{\sqrt{3}-\sqrt{2}} = 2$

10. (a) Expression

$= \sqrt{-\sqrt{3}+\sqrt{3+8\sqrt{7+4\sqrt{3}}}}$

$= \sqrt{-\sqrt{3} + \sqrt{3 + 8\sqrt{4 + 3 + 2.2\sqrt{3}}}}$

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

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

$= \sqrt{-\sqrt{3} + \sqrt{19 + 8\sqrt{3}}}$

$= \sqrt{-\sqrt{3} + \sqrt{16 + 3 + 2.4\sqrt{3}}}$

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

$= \sqrt{-\sqrt{3} + 4 + \sqrt{3}} = \sqrt{4} = 2$

11. (c) $x = \frac{1}{2 + \sqrt{3}} = \frac{2 - \sqrt{3}}{(2 + \sqrt{3})(2 - \sqrt{3})}$

$= \frac{2 - \sqrt{3}}{4 - 3} = 2 - \sqrt{3}$

$x + 1 = 3 - \sqrt{3}$

Similarly, $y + 1 = 3 + \sqrt{3}$

$\therefore \quad \frac{1}{x+1} + \frac{1}{y+1}$

$\frac{1}{3 - \sqrt{3}} + \frac{1}{3 + \sqrt{3}}$

$= \frac{3 + \sqrt{3} + 3 - \sqrt{3}}{(3 - \sqrt{3})(3 + \sqrt{3})}$

$= \frac{6}{9 - 3} = 1$

12. (c) $x = 2 - 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$

$\Rightarrow \quad x - 2 = 2^{\frac{2}{3}} - 2^{\frac{1}{3}}$

On Cubing

$x^3 - 3x^2 \times 2 + 3x \times 4 - 8$

$= \left(2\frac{2}{3}\right)^3 - \left(2^{\frac{1}{3}}\right)^3$

$-3.2^{\frac{2}{3}}.2^{\frac{1}{3}}\left(2^{\frac{2}{3}} - 2^{\frac{1}{3}}\right)$

$\Rightarrow \quad x^3 - 6x^2 + 12x - 8 = 4 - 2 - 6(x - 2)$

$\Rightarrow \quad x^3 - 6x^2 + 12x - 8$

$= 2 - 6x + 12$

$\Rightarrow \quad x^3 - 6x^2 + 18x + 18$

$= 2 + 12 + 8 + 18 = 40$

13. (d) $a^3 + b^3 + c^3 - 3\,abc = 0$

If $a + b + c = 0$

$\therefore \quad a^3 - b^3 - c^3 - 3\,abc = 0$

$\Rightarrow \quad a - b - c = 0$

$\Rightarrow \quad a = b + c$

14. (c) $P(x) = ax^3 + 3x^2 - 8x + b$

$\therefore \quad P(-2) = -8a = 12 + 16 + b = 0$

$\Rightarrow \quad -8a + b + 28 = 0$ ....(i)

$\Rightarrow \quad P(2) = 8a + 12 - 16 + b = 2$

$\Rightarrow \quad 8a + b - 4 = 0$ ....(ii)

By equation (i) + (iii)

$2b + 24 = 0$

$\Rightarrow \quad b = -\frac{24}{2} = -12$

From equation (i),

$-8a - 12 + 28 = 0$

$\Rightarrow \quad -8a = -16$

$\Rightarrow \quad a = 2$

15. (b) $2x + y = 5$ .....(i)

$x + 2y = 4$ .....(ii)

By equation (i) × 2 – equation (ii), we have

$4x + 2y = 10$

$x + 2y = 4$

$- \quad - \qquad -$

$3x = 6$

$\Rightarrow x = 2$

From equation (i),

$2 \times 2 + y = 5$

$\Rightarrow y = 5 - 4 = 1$

$\therefore$ Point of intersection = (2, 1)

16. (a) $2^x.2^y = 8$

$\Rightarrow 2^{x+y} = 2^3$

$\Rightarrow x + y = 3$

$9^x.3^y = 3^4$

$\Rightarrow 3^{2x}.3^y = 3^4$

$\Rightarrow 2x + y = 4$ ....(ii)

By equation (i),

$x = 1$

From equation (i),

$1 + y = 3$

$\Rightarrow y = 2$

17. (b) $x = 3 + 2\sqrt{2}$

$\therefore \frac{1}{x} = \frac{1}{3 + 2\sqrt{2}}$

$= \frac{1}{3 + 2\sqrt{2}} \times \frac{3 - 2\sqrt{2}}{3 - 2\sqrt{2}}$

$= \frac{3 - 2\sqrt{2}}{9 - 8} = 3 - 2\sqrt{2}$

$\therefore \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 = x + \frac{1}{x} - 2$

$= 3 + 2\sqrt{2} + 3 - 2\sqrt{2} - 2 = 4$

$\therefore \sqrt{x} - \frac{1}{\sqrt{x}} = 2$

18. (a) $25a^2 + 40ab + 16b^2$

$= (5a + 4b)^2$

$= (5 \times 23 - 29 \times 4)^2$

$= (115 - 116)^2 = 1$

19. (a) $\frac{a}{3} = \frac{b}{2} \Rightarrow \frac{a}{b} = \frac{3}{2}$

$\therefore \frac{2a + 3b}{3a - 2b} = \frac{2 \times \frac{a}{b} + 3}{3 \times \frac{a}{b} - 2}$

$= \frac{2 \times \frac{3}{2} + 3}{3 \times \frac{3}{2} - 2} = \frac{6}{\frac{9 - 4}{2}} = \frac{12}{5}$

20. (b) Sum of x numbers = xy

Sum of y numbers = xy

$\therefore$ Required average

$= \frac{xy + xy}{x + y} = \frac{2xy}{x + y}$

21. (a) $x + \frac{1}{4x} = \frac{3}{2}$

$\Rightarrow 2x + \frac{1}{2x} = 3$

Cubing both sides,

$8x^3 + \frac{1}{8x^3} + 3 \times 2x \times \frac{1}{2x}$

$\left(2x + \frac{1}{2x}\right) = 27$

$\Rightarrow 8x^3 + \frac{1}{8x^3} + 3 \times 3 = 27$

$\Rightarrow 8x^3 + \frac{1}{8x^3} = 27 - 9 = 18$

22. (d) $x = \frac{4ab}{a + b} \Rightarrow \frac{x}{2a} = \frac{2b}{a + b}$

By componendo and dividendo,

$$\frac{x+2a}{x-2a}=\frac{2b+a+b}{2b-a-b}=\frac{3b+a}{b-a}$$

Again,

$$\frac{x}{2b}=\frac{2a}{a+b}$$

$$\Rightarrow \frac{x+2b}{x-2b}=\frac{2a+a+b}{2a-a-b}=\frac{3a+b}{a-b}$$

$$\therefore \frac{x+2a}{x-2a}+\frac{x+2b}{x-2b}$$

$$=\frac{3b+a}{b-a}+\frac{3a+b}{a-b}$$

$$=\frac{3b+a-3a-b}{b-a}=\frac{2b-2a}{b-a}$$

$$=\frac{2(b-a)}{b-a}=2$$

23. (a) $x^2+y^2-z^2+2xy$

$$=x^2+y^2+2xy-z^2$$

$$=(x+y)^2-z^2=(x+y+z)(x+y-z)$$

$$=(b+c-2a+c+a-2b+a+b-2c)(x+y-z)$$

24. (d) $(a-1)^2+(b+2)^2+(c+1)^2=0$

$\Rightarrow a-1=0 \Rightarrow a=1;$

$b+2=0 \Rightarrow b=-2$

$c+1=0 \Rightarrow c=-1$

$\therefore 2a-3b+7c$

$=2-3(-2)+7(-1)$

$=2+6-7=1$

25. (a) $x^2+y^2+\frac{1}{x^2}+\frac{1}{y^2}-4=0$

$$\Rightarrow x^2+\frac{1}{x^2}-2+y^2+\frac{1}{y^2}-2=0$$

$$\Rightarrow \left(x-\frac{1}{x}\right)^2+\left(y-\frac{1}{y}\right)^2=0$$

$$\Rightarrow x-\frac{1}{x}=0$$

$$\Rightarrow x^2-1=0 \Rightarrow x=1$$

Similarly,

$y=1$

$\therefore x^2+y^2=1+1=2$

26. (b) $x^2=y+z$

$\Rightarrow x^2+x=x+y+z$

$\Rightarrow x(x+1)=x+y+z$ .....(i)

Similarly,

$y(y+1)=x+y+z$ .....(ii)

and, $z(z+1)=x+y+z$ .....(iii)

$$\therefore \frac{1}{x+1}+\frac{1}{y+1}+\frac{1}{z+1}$$

$$=\frac{x}{x+y+z}+\frac{y}{x+y+z}+\frac{z}{x+y+z}$$

$$=\frac{x+y+z}{x+y+z}=1$$

27. (a) $x+\frac{1}{x}=\sqrt{3}$

Cubing both sides,

$$x^3+\frac{1}{x^3}+3\left(x+\frac{1}{x}\right)=\left(\sqrt{3}\right)^3$$

$$\Rightarrow x^3+\frac{1}{x^3}+3\sqrt{3}=3\sqrt{3}$$

$$\Rightarrow x^3+\frac{1}{x^3}=0$$

Now, $x^{18}+x^{12}+x^6+1$

$$=x^{12}\left(x^6+1\right)+1\left(x^6+1\right)$$

$$=\left(x^{12}+1\right)\left(x^6+1\right)$$

$$=\left(x^{12}+1\right).\,x^3\left(x^3+\frac{1}{x^3}\right)=0$$

28. (d) $(ad - bc)^2 + (ac + bd)^2$

$= a^2d^2 + b^2c^2 - 2abcd + a^2c^2 + b^2d^2 - 2abcd$

$= a^2d^2 + b^2c^2 + a^2c^2 + b^2d^2$

$= a^2d^2 + b^2d^2 + b^2c^2 + a^2c^2$

$= d^2(a^2 + b^2) + c^2(b^2 + a^2)$

$= (a^2 + b^2)(c^2 + d^2)$

$= 2 \times 1 = 2$

29. (b) $x + \frac{1}{x} = 5$

$\Rightarrow x^2 - 5x + 1 = 0$

$\Rightarrow 3x^2 - 15x + 3 = 0$

$\therefore \frac{2x}{3x^2 - 5x + 3} = \frac{2x}{15x - 5x}$

$= \frac{2x}{10x} = \frac{1}{5}$

30. (d) $x^4 + \frac{1}{x^4} = 119$

$\Rightarrow x^4 + \frac{1}{x^4} = 119$

$\Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 = 121$

$\Rightarrow x^2 + \frac{1}{x^2} = 11$

$\Rightarrow \left(x - \frac{1}{x}\right)^2 + 2 = 11$

$\Rightarrow \left(x - \frac{1}{x}\right)^2 = 9 \Rightarrow x - \frac{1}{x} = 3$

Cubing both sides,

$\left(x - \frac{1}{x}\right)^3 = 27$

$\Rightarrow x^3 - \frac{1}{x^3} - 3\left(x - \frac{1}{x}\right) = 27$

$\Rightarrow x^3 - \frac{1}{x^3} - 3 \times 3 = 27$

$\Rightarrow x^3 - \frac{1}{x^3} = 27 + 9 = 36$

31. (a) $x - y = \frac{x + y}{7} = \frac{xy}{4} = k$

$\Rightarrow x - y = k$

$x + y = 7k$

$\therefore (x + y)^2 - (x - y)^2 = 49k^2 - k^2$

$\Rightarrow 4xy = 48k^2$

$\Rightarrow 16k = 48k^2$

$\Rightarrow k = \frac{1}{3}$

$\therefore xy = 4k = 4 \times \frac{1}{3} = \frac{4}{3}$

32. (d) $(x + y - z)^2 + (y + z - x)^2 + (z + x - y)^2 = 0$

$\Rightarrow (x + y - z) = 0$

33. (d) $\frac{x^2}{yz} + \frac{y^2}{zx} + \frac{z^2}{xy}$

$= \frac{x^3 + y^3 + z^3}{xyz} = \frac{3xyz}{xyz} = 3$

34. (a) $x^2 + 2 = 2x$

$\Rightarrow x^2 - 2x + 2 = 0$

$x^2 - 2x + 2\,)\,x^4 - x^3 + x^2 + 2\,(\,x^2 + x + 1$

$x^4 - 2x^3 + 2x^2$

$- \quad + \quad -$

$x^3 - x^2 + 2$

$x^3 - 2x^2 + 2x$

$- \quad + \quad -$

$x^2 - 2x + 2$

$x^2 - 2x + 2$

$\times$

35. (a) $\frac{1}{x+y} = \frac{1}{x} + \frac{1}{y} = \frac{y+x}{xy}$

$\Rightarrow (x+y)^2 = xy$

$\Rightarrow x^2 + 2xy + y^2 = xy$

$\Rightarrow x^2 + xy + y^2 = 0$

$\therefore x^3 - y^3 = (x-y)(x^2 + xy + y^2)$

$= 0$

36. (b) $a^2 + b^2 + c^2 = ab + bc + ca$

$\Rightarrow 2a^2 + 2b^2 + 2c^2$

$= 2ab + 2bc + 2ca$

$\Rightarrow$

$a^2 - 2ab + b^2 + b^2 - 2bc + c^2 + c^2 - 2ac + a^2 = 0$

$\Rightarrow (a-b)^2 + (b-c)^2 + (c-a)^2 = 0$

$\Rightarrow a - b = 0 \Rightarrow a = b$

$b - c = 0 \Rightarrow b = c$

$c - a = 0 \Rightarrow c = a$

$\Rightarrow a = b = c$

$\therefore \frac{a+c}{b} = \frac{a+a}{a} = 2$

37. (b) $\frac{1}{(a+b)(b+c)} + \frac{1}{(a+c)(b+a)} + \frac{1}{(c+a)(c+b)}$

$= \frac{c+a+b+c+a+b}{(a+b)(b+c)(c+a)}$

$= \frac{2(a+b+c)}{(a+b)(b+c)(c+a)}$

$= 0$ because $a + b + c = 0$

38. (b) $3x + \frac{1}{2x} = 5$

On multiplying both sides by $\frac{2}{3}$,

$2x + \frac{1}{3x} = \frac{10}{3}$

Cubing both sides,

$8x^3 + \frac{1}{27x^3} + 3 \times 2x \times \frac{1}{3x}$

$\left(2x + \frac{1}{3x}\right) = \frac{1000}{27}$

$\Rightarrow 8x^3 + \frac{1}{27x^3} + 2 \times \frac{10}{3} = \frac{1000}{27}$

$\Rightarrow 8x^3 + \frac{1}{27x^3} = \frac{1000}{27} - \frac{20}{3}$

$= \frac{1000-180}{27} = \frac{820}{27} = 30\frac{10}{27}$

39. (c) $\frac{x + \frac{1}{x}}{2} = M$

$\therefore x + \frac{1}{x} = 2M$

Required average

$= \frac{x^2 + \frac{1}{x^2}}{2} = \frac{\left(x + \frac{1}{x}\right)^2 - 2}{2}$

$= \frac{4M^2 - 2}{2} = 2M^2 - 1$

40. (c) $a^2 + b^2 + c^2 = 2a - 2b - 2c - 3$

$\Rightarrow a^2 - 2a + b^2 + 2b + c^2 + 2c + 1 + 1 + 1 = 0$

$\Rightarrow (a^2 - 2a + 1) + (b^2 + 2b + 1) + (c^2 + 2c + 1) = 0$

$\Rightarrow (a-1)^2 + (b+1)^2 + (c+1)^2 = 0$

$\Rightarrow a - 1 = 0 \Rightarrow a = 1$

$\Rightarrow b + 1 = 0 \Rightarrow b = -1$

and $c + 1 = 0 \Rightarrow c = -1$

$\therefore 2a - 3b + 4c = 2 + 3 - 4 = 1$

41. (c) $(a-3)^2 + (b-4)^2 + (c-9)^2 = 0$

$\Rightarrow$ $a - 3 = 0 \Rightarrow a = 3$

$b - 4 = 0 \Rightarrow b = 4$

and $c - 9 = 0$

$\Rightarrow$ $c = 9$

$\therefore$ $\sqrt{a+b+c}$

$= \sqrt{3+4+9}$

$= \sqrt{16} = \pm 4$

42. (a) $\sqrt{x} = \sqrt[3]{y}$

$\Rightarrow$ $x^{\frac{1}{2}} = y^{\frac{1}{3}}$

$\Rightarrow$ $(x^{\frac{1}{2}})^6 = (y^{\frac{1}{3}})^6$

$\Rightarrow$ $x^3 = y^2$

43. (b) $x + \frac{1}{x} = 2$

$\Rightarrow$ $x^2 + 1 = 2x$

$\Rightarrow$ $x^2 - 2x + 1 = 0$

$\Rightarrow$ $(x-1)^2 = 0$

$\Rightarrow$ $x = 1$

$\therefore$ $x^2 + \frac{1}{x^3} = 1 + 1 = 2$

44. (b) $a^2 + b^2 + c^2 + 3$

$= 2a + 2b + 2c$

$\Rightarrow$ $a^2 - 2a + 1 + b^2 - 2b + 1 + c^2 - 2c + 1 = 0$

$\Rightarrow$ $(a-1)^2 + (b-1)^2 + (c-1)^2 = 0$

$\Rightarrow$ $a - 1 = 0 \Rightarrow a = 1;$

$b - 1 = 0 \Rightarrow b = 1;$

and, $c - 1 = 0 \Rightarrow c = 1;$

$\therefore$ $a + b + c = 3$

45. (c) $\frac{2p}{p^2 - 2p + 1} = \frac{1}{4}$

$\Rightarrow$ $\frac{p^2 - 2p + 1}{2p} = 4$

$\Rightarrow$ $\frac{p^2 - 2p + 1}{p} = 8$

$\Rightarrow$ $\frac{p^2}{p} - \frac{2p}{p} + \frac{1}{p} = 8$

$\Rightarrow$ $p + \frac{1}{p} = 8 + 2 = 10$

46. (a) $x \propto \frac{1}{y^2 - 1}$

$\Rightarrow$ $x = \frac{k}{y^2 - 1}$

Where k is a constant.

When y = 10, x = 24, then

$\therefore$ $24 = \frac{k}{10^2 - 1} \Rightarrow 24 = \frac{k}{99}$

$\Rightarrow$ $k = 24 \times 99$

When y = 5, then

$x = \frac{k}{y^2 - 1} = \frac{24 \times 99}{5^2 - 1} = \frac{24 \times 99}{24} = 99$

47. (c) $a^2 = b + c$

$\Rightarrow$ $a^2 + a = a + b + c$

$\Rightarrow$ $a(a+1) = a + b + c$

$\Rightarrow$ $(a+1) = \frac{a+b+c}{a}$

$\Rightarrow$ $\frac{1}{(a+1)} = \frac{a}{a+b+c}$

Similarly,

$b^2 = c + a$