12.5

1. $x + 3y + 2z = 3$
5. $x = 3$
9. $x + y + z = 0$
11. **b**, **d**
13. $(9, -4, -11)$
15. $(3, -8, 11)$
17. $\mathrm{P} = (2, -1, 4), \mathrm{Q} = (1,1,1), \mathrm{R} = (3, 1, -2)$

$$\overrightarrow{PQ} = (-1, 2, -3)\ \overrightarrow{PR} = (1, 2, -6)\ \overrightarrow{PQ} \times \overrightarrow{PR} = \begin{matrix} i & j & k \\ -1 & 2 & -3 \\ 1 & 2 & -6 \end{matrix} = -6i - 9j - 4k = (-6, -9, -4)$$

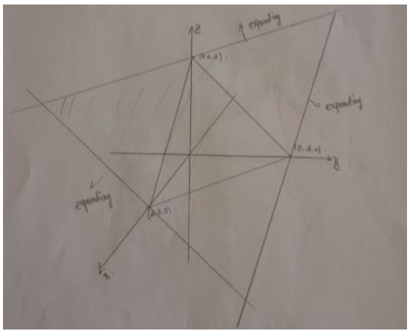
$the\ equation\ of\ the\ plane\ is - 6 * (x - 1) - 9 * (y - 1) - 4 * (z - 1) = 0$

19. $P = (1,0,0)\ Q = (0,1,1)\ R = (2,0,1)$

$$\overrightarrow{PQ} = (-1,1,1)\ \overrightarrow{PR} = (1,0,1)\ \overrightarrow{PQ} \times \overrightarrow{PR} = \begin{matrix} i & j & k \\ -1 & 1 & 1 \\ 1 & 0 & 1 \end{matrix} = i + 2j - k = (1, 2, -1)$$

$the\ equation\ of\ the\ plane\ is\ (x - 1) + 2y - z = 0$

25. $(x + 2) + (z - 5) = 0, y \in R$
31.



53. $the\ normal\ vector\ of\ xz - plane\ is\ n_1 = (0,1,0)$

$we\ assume\ that\ the\ other\ plane\ is\ a * x + b * y + c * z = \alpha$

$and\ the\ normal\ vector\ of\ the\ plan\ is\ n_2 = (a, b, c)$

$$the\ result\ of\ n_1 \times n_2 = \begin{matrix} i & j & k \\ 0 & 1 & 0 \\ a & b & c \end{matrix} = c * i - a * k\ and\ we\ can\ know\ \begin{cases} a = -2 \\ c = 3 \end{cases}$$

So, the equation of planes is:

$(-2) * (x - 1) + b * y + 3 * (z - 1) = 0, b\ could\ be\ any\ real\ number$