

NS Home Exercise 2B

$$1) (a) \quad 9a^2 - 25 = (3a - 5)(3a + 5)$$

$$(b) \quad 4w^2 - 36 = 4(w^2 - 9) = 4(w - 3)(w + 3)$$

$$2) (a) \quad 12x + 7y = 200$$

$$(b) \quad 8x + 9y = 220$$

$$(c) \quad 12x + 7y = 200 \quad (1) \quad \times 9$$

$$8x + 9y = 220 \quad (2) \quad \times 7$$

$$\therefore 108x + 63y = 1800 \quad (3)$$

$$56x + 63y = 1540 \quad (4)$$

$$(3) - (4) \quad 52x = 260$$

$$\Rightarrow \underline{x = 5}$$

$x = 5$ substituted into (2) gives $9y = 220 - 40$,

$$\text{i.e., } 9y = 180 \Rightarrow \underline{y = 20}$$

\therefore Standard rate = 5 p/min.

Peak rate = 20 p/min.

$$3) (a) \quad p = nr - t$$

$$p + t = nr$$

$$\boxed{r = \frac{p+t}{n}}$$

$$\left(\begin{array}{l} r \xrightarrow{\times n} nr \xrightarrow{-t} nr-t = p \\ \frac{p+t}{n} \xleftarrow{\div n} p+t \xleftarrow{+t} p \\ \therefore \boxed{r = \frac{p+t}{n}} \end{array} \right)$$

$$(b) \quad w = r^2 + h$$

$$w - h = r^2$$

$$\boxed{r = \pm \sqrt{w-h}}$$

$$\left(\begin{array}{l} r \xrightarrow{^2} r^2 \xrightarrow{+h} r^2+h = w \\ \sqrt{w-h} \xleftarrow{\sqrt{\quad}} w-h \xleftarrow{-h} w \\ \therefore \boxed{r = \pm \sqrt{w-h}} \end{array} \right)$$

$$4) (a) \quad 1 \text{ mg} \leftrightarrow 1.504 \times 10^{20} \text{ atoms}$$

$$\therefore 5 \text{ g} \leftrightarrow 1.504 \times 10^{20} \times 1000 \times 5 \text{ atoms}$$

$$\Rightarrow 5 \text{ g} \leftrightarrow 7.52 \times 10^{23} \text{ atoms}$$

$$\text{So, } \boxed{5 \text{ g has } 7.52 \times 10^{23} \text{ atoms (3 s.f.)}}$$

$$(b) \quad 1.504 \times 10^{20} \text{ atoms} \leftrightarrow 1 \text{ mg}$$

$$\therefore 1 \text{ atom} \leftrightarrow 1 \div 1.504 \times 10^{20} \text{ mg}$$

$$\Rightarrow 1 \text{ atom} \leftrightarrow 6.64893... \times 10^{-21} \text{ mg}$$

$$\text{So, } \boxed{\text{mass of 1 atom} = 6.65 \times 10^{-21} \text{ mg (3 s.f.)}}$$

5) 'Dye' and 'Salt' are already below 120 units, so a reduction will keep them below 120 units.

For 'Oil', amount left after 3 years is,

$$138 \times (0.95)^3 = \underline{118.3}$$

As 'Tyre' and 'Iron' start with less than 138 units, after 3 years their values will be less than 118.3 (and hence less than 120) units.

More details:

$$\text{Dye} : 115 \times (0.95)^3 = 98.6 \text{ units}$$

$$\text{Oil} : 138 \times (0.95)^3 = 118.3 \text{ units}$$

$$\text{Tyre} : 132 \times (0.95)^3 = 113.2 \text{ units}$$

$$\text{Iron} : 128 \times (0.95)^3 = 109.7 \text{ units}$$

$$\text{Salt} : 106 \times (0.95)^3 = 90.9 \text{ units}$$

As all factories' outputs are less than 120 units after 3 years, all factories meet the government requirements.