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Solutions of

UNIT#18

Exercise 18.2

Class 10 Math Sindh Board

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Solutions of Exercise 18.2

1. 📈 Direct Variation ($y \propto x$)

Given: y varies directly as x, and $y = 10$ when $x = 3$.

The relationship is $y = kx$, where k is the constant of variation.

(i) Find y in terms of x

Step 1: Find the constant k. Using the given values $y = 10$ and $x = 3$:

$$10 = k(3)$$

$$k = \frac{10}{3}$$

Step 2: Write the equation. Substitute k back into $y = kx$:

$$y = \frac{10}{3}x$$

(ii) Find y when $x = 6$

Substitute $x = 6$ into the equation:

$$y = \frac{10}{3}(6)$$

$$y = 10 \times 2$$

$$y = 20$$

(iii) Find x when $y = 15$

Substitute $y = 15$ into the equation:

$$15 = \frac{10}{3}x$$

Multiply both sides by 3:

$$45 = 10x$$

Divide by 10:

$$x = \frac{45}{10} = \frac{9}{2} \text{ or } 4.5$$

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2. 🌡️ Direct Variation ($V \propto T$)

Given: $V \propto T$, and $V = 15$ when $T = 24$.

The relationship is $V = kT$.

(i) The equation connecting V and T

Step 1: Find the constant k. Using $V = 15$ and $T = 24$:

$$15 = k(24)$$

$$k = \frac{15}{24}$$

Simplify k by dividing numerator and denominator by 3:

$$k = \frac{5}{8}$$

Step 2: Write the equation.

$$V = \frac{5}{8}T$$

(ii) V when $T = 30$

Substitute $T = 30$ into the equation:

$$V = \frac{5}{8}(30)$$

$$V = \frac{5 \times 30}{8} = \frac{150}{8}$$

Simplify by dividing numerator and denominator by 2:

$$V = \frac{75}{4} \text{ or } 18.75$$

(iii) T **when** $V = 10$

Substitute $V = 10$ into the equation:

$$10 = \frac{5}{8}T$$

Multiply both sides by $\frac{8}{5}$:

$$T = 10 \times \frac{8}{5}$$

$$T = 2 \times 8$$

$$T = 16$$

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3. ➗ Direct Variation ($u \propto \sqrt[3]{v}$)

Given: $u \propto \sqrt[3]{v}$, and $u = 4$ when $v = 64$.

The relationship is $u = k\sqrt[3]{v}$.

Step 1: Find the constant k**.** Using $u = 4$ and $v = 64$:

$$4 = k\sqrt[3]{64}$$

Since $\sqrt[3]{64} = 4$:

$$4 = k(4)$$

$$k = 1$$

The equation connecting u and v is $u = \sqrt[3]{v}$.

Step 2: Find the value of u when $v = 216$.

$$u = \sqrt[3]{216}$$

Since $6^3 = 216$:

$$u = 6$$

Step 3: Find the value of v when $u = 5$.

$$5 = \sqrt[3]{v}$$

Cube both sides:

$$v = 5^3$$

$$v = 125$$

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4. 🚀 Direct Variation ($F \propto m^3$)

Given: F varies directly as m^3, and $F = 81$ when $m = 3$.

The relationship is $F = km^3$.

Step 1: Find the constant k. Using $F = 81$ and $m = 3$:

$$81 = k(3^3)$$

$$81 = k(27)$$

$$k = \frac{81}{27}$$

$$k = 3$$

The equation is $F = 3m^3$.

Step 2: Find F when $m = 5$. Substitute $m = 5$ into the equation:

$$F = 3(5^3)$$

$$F = 3(125)$$

$$F = 375$$

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5. 📉 Inverse Variation ($y \propto \frac{1}{x}$)

Given: y varies inversely as x, and $y = 10$ when $x = 3$.

The relationship is $y = \frac{k}{x}$, or $xy = k$.

Step 1: Find the constant k. Using $y = 10$ and $x = 3$:

$$10 = \frac{k}{3}$$

$$k = 10 \times 3$$

$$k = 30$$

The equation is $y = \frac{30}{x}$.

Step 2: Find y when $x = 10$. Substitute $x = 10$ into the equation:

$$y = \frac{30}{10}$$

$$y = 3$$

6. Inverse Variation ($V \propto \frac{1}{\sqrt{P}}$)

Given: The volume V of a gas varies inversely as the square root of the pressure P of the gas, and $V = 12$ when $P = 9$.

The relationship is $V = \frac{k}{\sqrt{P}}$, or $V\sqrt{P} = k$.

Step 1: Find the constant k. Using $V = 12$ and $P = 9$:

$$12 = \frac{k}{\sqrt{9}}$$

$$12 = \frac{k}{3}$$

$$k = 12 \times 3$$

$$k = 36$$

The equation is $V = \frac{36}{\sqrt{P}}$.

Step 2: Find P when $V = 4$. Substitute $V = 4$ into the equation:

$$4 = \frac{36}{\sqrt{P}}$$

Multiply by $\sqrt{P}$ and divide by 4:

$$\sqrt{P} = \frac{36}{4}$$

$$\sqrt{P} = 9$$

Square both sides:

$$P = 9^2$$

$$P = 81$$

7. 📏 Inverse Square Law ($F \propto \frac{1}{r^2}$)

Given: $F \propto \frac{1}{r^2}$, and $F = 8$ when $r = 2$.

The relationship is $F = \frac{k}{r^2}$, or $Fr^2 = k$.

Step 1: Find the constant k. Using $F = 8$ and $r = 2$:

$$8 = \frac{k}{2^2}$$

$$8 = \frac{k}{4}$$

$$k = 8 \times 4$$

$$k = 32$$

The equation is $F = \frac{32}{r^2}$.

(i) Find F when $r = 5$

Substitute $r = 5$ into the equation:

$$F = \frac{32}{5^2}$$

$$F = \frac{32}{25} \text{ or } 1.28$$

(ii) Find r when $F = 24$

Substitute $F = 24$ into the equation:

$$24 = \frac{32}{r^2}$$

Rearrange to solve for r^2:

$$r^2 = \frac{32}{24}$$

Simplify the fraction by dividing numerator and denominator by 8:

$$r^2 = \frac{4}{3}$$

Take the square root (assuming r is positive, as it likely represents a distance):

$$r = \sqrt{\frac{4}{3}} = \frac{\sqrt{4}}{\sqrt{3}}$$

$$r = \frac{2}{\sqrt{3}}$$

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8. 📐 Combined Variation ($\sqrt[3]{x} \propto y^2$)

Given: The cube root of x varies as the square of y, and $x = 8$ when $y = 3$.

The relationship is $\sqrt[3]{x} = ky^2$.

Step 1: Find the constant k. Using $x = 8$ and $y = 3$:

$$\sqrt[3]{8} = k(3^2)$$

$$2 = k(9)$$

$$k = \frac{2}{9}$$

The equation is $\sqrt[3]{x} = \frac{2}{9}y^2$.

Step 2: Find x when $y = \frac{3}{2}$. Substitute $y = \frac{3}{2}$ into the equation:

$$\sqrt[3]{x} = \frac{2}{9}\left(\frac{3}{2}\right)^2$$

$$\sqrt[3]{x} = \frac{2}{9}(\frac{9}{4})$$

$$\sqrt[3]{x} = \frac{2 \times 9}{9 \times 4} = \frac{2}{4}$$

$$\sqrt[3]{x} = \frac{1}{2}$$

Cube both sides to find x:

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

$$x = \frac{1}{8}$$

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9. ⚛️ Gravitational Inverse Square Law ($F \propto \frac{1}{d^2}$)

Given: The force F varies inversely proportional to the square of the distance d between their centers, and $F = 2$ when $d = 3$.

The relationship is $F = \frac{k}{d^2}$, or $Fd^2 = k$.

Step 1: Find the constant k. Using $F = 2$ and $d = 3$:

$$2 = \frac{k}{3^2}$$

$$2 = \frac{k}{9}$$

$$k = 2 \times 9$$

$$k = 18$$

The equation is $F = \frac{18}{d^2}$.

Step 2: Find d when $F = 72$. Substitute $F = 72$ into the equation:

$$72 = \frac{18}{d^2}$$

Rearrange to solve for d^2:

$$d^2 = \frac{18}{72}$$

Simplify the fraction:

$$d^2 = \frac{1}{4}$$

Take the square root (assuming d is positive distance):

$$d = \sqrt{\frac{1}{4}}$$

$$d = \frac{1}{2} \text{ or } 0.5$$

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10. ⬇️ Inverse Variation ($y \propto \frac{1}{x-5}$)

Given: y varies inversely as $(x - 5)$, and $y = 6$ when $x = 8$.

The relationship is $y = \frac{k}{x-5}$.

Step 1: Find the constant k. Using $y = 6$ and $x = 8$:

$$6 = \frac{k}{8 - 5}$$

$$6 = \frac{k}{3}$$

$$k = 6 \times 3$$

$$k = 18$$

The equation is $y = \frac{18}{x-5}$.

Step 2: Find y when $x = 10$. Substitute $x = 10$ into the equation:

$$y = \frac{18}{10 - 5}$$

$$y = \frac{18}{5} \text{ or } 3.6$$