Sec 1 Math: Linear Equation

A) Solving Linear Equations (Basic)

Solve the following Equations

a) $2x + 6 = 3x - 5$

b) $\frac{3x-2}{5} = 8$

c) $\frac{2}{3} - \frac{2x-9}{6} = 0$

d) $x^2 = 9$

e) $\sqrt{1+x} = 4$

f) $3x - 4(x-2) = 13 - 3(4+x)$

a) $2x + 6 = 3x - 5$
$2x - 3x = -5 - 6$
$-x = -11$
$x = 11$ (multiply both sides by -1)

b) $\frac{3x-2}{5} = 8$
$3x - 2 = 5 \times 8$ (Multiply both sides by 8)
$3x - 2 = 40$
$3x = 42$
$x = \frac{42}{3}$ (Divide both sides by 3)
$x = 14$

c) $\frac{2}{3} - \frac{2x-9}{6} = 0$
$\frac{4}{6} - \frac{2x-9}{6} = 0$ (Change fractions to same denominator)
$\frac{4-2x+9}{6} = 0$
$4 - 2x + 9 = 0$ (Multiply both sides by 6)
$-2x = -13$
$x = \frac{-13}{-2}$
$x = 6.5$

d) $x^2 = 9$ (Square root both sides)
$x = \pm\sqrt{9}$ (Add $\pm$ whenever square root both sides)
$x = 3$ or $x = -3$

e) $\sqrt{1+x} = 4$
$1 + x = 4^2$ (Square both sides)
$x = 16 - 1$
$x = 15$

f) $3x - 4(x-2) = 13 - 3(4+x)$
$3x - 4x + 8 = 13 - 12 - 3x$ (Expand)
$3x - 4x + 3x = 13 - 12 - 8$
$2x = -7$
$x = -\frac{7}{2}$
$x = -3.5$

B) Solving Linear Equations (Intermediate)

Solve the following Equations

a) $\frac{2x}{3} - \frac{x+1}{5} = 1 - \frac{2x-1}{15}$

b) $\frac{3}{x+1} = \frac{6}{4x-1}$

a) $\frac{2x}{3} - \frac{x+1}{5} = 1 - \frac{2x-1}{15}$
$\frac{10x}{15} - \frac{3(x+1)}{15} = \frac{15}{15} - \frac{2x-1}{15}$
$\frac{10x-3x-3}{15} = \frac{15-2x+1}{15}$
$10x - 3x - 3 = 15 - 2x + 1$ (both sides x 15)
$10x - 3x + 2x = 15 + 1 + 3$
$9x = 19$
$x = \frac{19}{9}$
$x = 2\frac{1}{9}$

b) $\frac{3}{x+1} \times \frac{6}{4x-1}$ (Cross Multiply)
$3(4x-1) = 6(x+1)$
$12x - 3 = 6x + 6$
$12x - 6x = 6 + 3$
$6x = 9$
$x = \frac{9}{6}$
$x = 1\frac{1}{2}$

C) Solving Linear Equations (Intermediate)

a) If $\frac{3x-4y}{2x-3y} = \frac{4}{5}$**, find the value of** $\frac{x}{y}$**.**

b) If $\frac{x+2y}{5x-4y} = \frac{1}{3}$**, find ratio** $x : y$

a) $\frac{3x-4y}{2x-3y} \times \frac{4}{5}$ (Cross Multiply)
$5(3x-4y) = 4(2x-3y)$
$15x - 20y = 8x - 12y$
$7x = 8y$
$\frac{7x}{7y} = \frac{8y}{7y}$ (Divide both side by $7y$)
$\frac{x}{y} = \frac{8}{7}$
$\frac{x}{y} = 1\frac{1}{7}$

b) $\frac{x+2y}{5x-4y} = \frac{1}{3}$ (Cross Multiply)
$3(x+2y) = 1(5x-4y)$
$3x + 6y = 5x - 4y$
$-2x = -10y$
$\frac{-2x}{-2y} = \frac{-10y}{-2y}$
$\frac{x}{y} = \frac{5}{1}$
$x : y = 5 : 1$

D) Forming Equations (Basic)

a) The sum of 3 consecutive odd integers is 171. Form an equation and find the smallest integer.

Let smallest integer be x
$\therefore x + (x+2) + (x+4) = 171$
$3x + 6 = 171$
... Continue to solve for x. $(x = 55)$

b) The numerator of a fraction is 1 less than the denominator. If 1 is added to the numerator and 2 is added to the denominator, the fraction is $\frac{3}{4}$**. Find the original fraction.**

Let the numerator be x, $\therefore$ denominator $= x + 1$
$\frac{x+1}{x+1+2} = \frac{3}{4}$
$4(x+1) = 3(x+1+2)$
... Continue solve for x. ($x = 5$, Fraction is $\frac{5}{6}$)

c) Alvin bought x **comics for** $\$6.50$ **each and twice as many novels at** $\$8.50$ **each. He paid a total of** $\$141$**. Form an equation and find the total number of books he bought.**

$6.5x + 8.5\,(2x) = 141$
$6.5x + 17x = 141$
... Continue solve for x. ($x = 6$, bought 18 books)

d) In an exam, John scored 80 marks less than Dean. While Bill scored twice that of John. The total score of the three boys is 980 marks. Form an equation and find Dean's score.

Let Dean's score be x. $\therefore$ John $= x - 80$ and Bill $= 2(x - 80)$
$x + (x - 80) + 2(x - 80) = 980$
... Continue solve for x. ($x = 305$)

E) Forming Equations (Intermediate/Advanced)

a) A father is 27 years older than his son. In 12 years' time, he will be twice as old as his son. Form an equation and find the present age of the son.

Let Son's present age be x.

	Present	12 Years Later
Son	x	$x + 12$
Father	$x + 27$	$x + 27 + 12$

$(x + 27 + 12) = 2(x + 12)$
$x + 39 = 2x + 24$
... continue solve for x. ($x = 15$)

b) A farmer has some ducks and sheeps. He counted 46 heads and 136 legs. Form an equation in x **and solve for the number of ducks.**

Let number of ducks be x
$\therefore$ number of sheeps is $46 - x$
Form an equation base on total number of legs:
$2x + 4\,(46 - x) = 136$
$2x + 184 - 4x = 136$

... continue solve for x. ($x = 24$)

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b) If $\frac{x+2y}{5x-4y} = \frac{1}{3}$, find ratio $x: y$

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b) The numerator of a fraction is 1 less than the denominator. If 1 is added to the numerator and 2 is added to the denominator, the fraction is $\frac{3}{4}$. Find the original fraction.

c) Alvin bought x comics for $\$6.50$ each and twice as many novels at $\$8.50$ each. He paid a total of $\$141$.
Form an equation and find the total number of books he bought.

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