I.G.C.S.E. Algebra 01

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Question 1

Simplify the following:

a. $\dfrac{9ab^2}{27ab}$

b. $\dfrac{7x+14y}{21xy}$

c. $\dfrac{x^2+3x-4}{x+4}$

d. $\dfrac{x^2-6x+8}{x^2+x-6}$

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Solution to question 1

a. $\dfrac{9ab^2}{27ab} = \dfrac{{}^{1}\cancel{9}\,\cancel{ab}^{\cancel{2}}}{{}^{3}\cancel{27}\,\cancel{ab}} = \dfrac{b}{3}$

b. $\dfrac{7x+14y}{21xy} = \dfrac{\cancel{7}\,(x+2y)}{{}^{3}\cancel{21}xy} = \dfrac{x+2y}{3xy}$

c. $\dfrac{x^2+3x-4}{x+4} = \dfrac{(x-1)\cancel{(x+4)}}{\cancel{(x+4)}} = x-1$

Note: x^2+3x-4
Product = -4
Sum = 3
Factors –1, 4
$\Rightarrow x^2 - x + 4x - 4$
$= x(x-1) + 4(x-1)$
$= (x-1)(x+4)$

d. $\dfrac{x^2-6x+8}{x^2+x-6} = \dfrac{\cancel{(x-2)}\,(x-4)}{\cancel{(x-2)}\,(x+3)} = \dfrac{x-4}{x+3}$

Note: x^2-6x+8
Product = 8
Sum = -6
Factors –2, -4
$\Rightarrow x^2 - 2x - 4x + 8$
$= x(x-2) - 4(x-2)$
$= (x-2)(x-4)$

Note: x^2+x-6
Product = -6
Sum = 1
Factors –2, 3
$\Rightarrow x^2 - 2x + 3x - 6$
$= x(x-2) + 3(x-2)$
$= (x-2)(x+3)$

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Question 2

Simplify the following:

a. $\frac{3x}{7} - \frac{x}{3}$

b. $\frac{3}{2x} + \frac{1}{5x}$

c. $\frac{x-3}{2} + \frac{x+5}{9}$

d. $\frac{2}{x-3} - \frac{3}{x+4}$

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Solution to question 2

a. $\frac{3x}{7}-\frac{x}{3}=\frac{3(3x)-7x}{(7)(3)}=\frac{9x-7x}{21}=\frac{2x}{21}$

b. $\frac{3}{2x}+\frac{1}{5x}=\frac{5(3)+2(1)}{2(5x)}=\frac{15+2}{10x}=\frac{17}{10x}$

c. $\frac{x-3}{2}+\frac{x+5}{9}=\frac{9(x-3)+2(x+5)}{(2)(9)}=\frac{9x-27+2x+10}{18}=\frac{11x-17}{18}$

d. $\frac{2}{x-3}-\frac{3}{x+4}=\frac{2(x+4)-3(x-3)}{(x-3)(x+4)}=\frac{2x+8-3x+9}{(x-3)(x+4)}=\frac{17-x}{(x-3)(x+4)}$

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Question 3

Make x the subject of the following formulae:

a. $Kx = G - R^2$ **b.** $z = S(x + t)$ **c.** $g = \dfrac{x - r}{e}$

d. $\dfrac{k^2(m - x)}{a} = a$ **e.** $\dfrac{t}{x} + n = k$ **f.** $\dfrac{z}{xy} - z = y$

g. $\sqrt{x - 3} = 4$ **h.** $y = \sqrt{c - x}$ **i.** $\sqrt{\dfrac{a}{x}} = G$

j. $y(x - a) = x + b$ **k.** $\dfrac{x + y}{x - y} = 2$ **l.** $x - n = \dfrac{x + 2}{n}$

m. $\sqrt{\dfrac{x + 1}{x}} = k$ **n.** $k\sqrt{\dfrac{x^2 - m}{n}} = \dfrac{k^2}{r}$

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Solution to question 3

a.

$$Kx = G - R^2$$

$$\frac{Kx}{K} = \frac{G - R^2}{K}$$

$$x = \frac{G - R^2}{K}$$

b.

$$z = S(x + t)$$

$$z = Sx + St$$

$$z - St = Sx + St - St$$

$$\frac{z - St}{S} = \frac{Sx}{S}$$

$$\frac{z - St}{S} = x$$

c.

$$g = \frac{x - r}{e}$$

$$eg = \frac{e(x - r)}{e}$$

$$eg = x - r$$

$$eg + r = x - r + r$$

$$eg + r = x$$

d.

$$\frac{k^2(m - x)}{a} = a$$

$$\frac{ak^2(m - x)}{a} = (a)(a)$$

$$k^2m - k^2x = a^2$$

$$k^2m - k^2x + k^2x - a^2 = a^2 + k^2x - a^2$$

$$\frac{k^2m - a^2}{k^2} = \frac{k^2x}{k^2}$$

$$\frac{k^2m - a^2}{k^2} = x$$

e.

$$\frac{t}{x} + n = k$$

$$\frac{t}{x} + n - n = k - n$$

$$\frac{xt}{x} = x(k - n)$$

$$\frac{t}{k - n} = \frac{x(k - n)}{k - n}$$

$$\frac{t}{k - n} = x$$

f.

$$\frac{z}{xy} - z = y$$

$$\frac{z}{xy} - z + z = y + z$$

$$\frac{xyz}{xy} = xy(y + z)$$

$$\frac{z}{y(y + z)} = \frac{xy(y + z)}{y(y + z)}$$

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

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g.

$$\sqrt{x-3}=4$$

$$x-3=4^2 \quad \text{(squaring both sides)}$$

$$x-3+3=16+3$$

$$x=19$$

h.

$$y=\sqrt{c-x}$$

$$y^2=c-x$$

$$y^2+x=c-x+x$$

$$y^2+x-y^2=c-y^2$$

$$x=c-y^2$$

i.

$$\sqrt{\frac{a}{x}}=G$$

$$\frac{a}{x}=G^2 \quad \text{(squaring)}$$

$$\frac{x\,a}{x}=xG^2$$

$$\frac{a}{G^2}=x$$

j.

$$y(x-a)=x+b$$

$$xy-ay=x+b$$

$$xy-ay-x+ay=x+b-x+ay$$

$$xy-x=b+ay$$

$$x(y-1)=b+ay$$

$$\frac{x(y-1)}{y-1}=\frac{ay+b}{y-1}$$

$$x=\frac{ay+b}{y-1}$$

k.

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

$$\frac{(x-y)(x+y)}{x-y}=2(x-y)$$

$$x+y=2x-2y$$

$$x+y-x+2y=2x-2y-x+2y$$

$$3y=x$$

l.

$$x-n=\frac{x+2}{n}$$

$$n(x-n)=\frac{n(x+2)}{n}$$

$$nx-n^2=x+2$$

$$nx-n^2+n^2-x=x+2+n^2-x$$

$$nx-x=2+n^2$$

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

$$x=\frac{2+n^2}{n-1}$$

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m.

$$\sqrt{\frac{x+1}{x}} = k$$

$$\frac{x+1}{x} = k^2 \quad \text{(squaring)}$$

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

$$x + 1 - x = k^2 x - x$$

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

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

n.

$$k\sqrt{\frac{x^2 - m}{n}} = \frac{k^2}{r}$$

$$\frac{k}{k}\sqrt{\frac{x^2 - m}{n}} = \frac{k^2}{kr}$$

$$\sqrt{\frac{x^2 - m}{n}} = \frac{k}{r}$$

$$\frac{x^2 - m}{n} = \frac{k^2}{r^2}$$

$$\frac{n(x^2 - m)}{n} = \frac{k^2 n}{r^2}$$

$$x^2 - m + m = \frac{k^2 n}{r^2} + m$$

$$x = \pm\sqrt{\frac{k^2 n}{r^2} + m}$$

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Question 4

A varies as directly as r^2. If $A = 16$, when $r = 2$, calculate:

a. the value of A, when $r = 3$;

b. the value of r, when $A = 64$.

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Solution to question 4

A varies as directly as r^2

$\Rightarrow A \propto r^2 \Rightarrow A = kr^2$ when $A = 16$, $r = 2$

$$A = kr^2$$
$$16 = k\left(2^2\right)$$
$$16 = 4k$$
$$\frac{16}{4} = k$$

$\Rightarrow k = 4,$ and therefore $A = 4r^2$

a. $A = 4r^2$

$\Rightarrow A = 4\left(3^2\right) = 4(9) = 36$

b. $A = 4r^2$

$\Rightarrow 64 = 4r^2 \Rightarrow r^2 = 16 \Rightarrow r = 4$

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Question 5

The volume V of a given mass of gas varies inversely as the pressure P. When $V = 3\text{m}^3, P = 400\text{N/m}^2$. Find the volume when the pressure is $P = 300\text{N/m}^2$. Find the pressure when the volume is $V = 6\text{m}^3$.

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Solution to question 5

The volume V of a given mass of gas varies inversely as the pressure P. When $V = 3\text{m}^3, P = 400\text{N/m}^2$. Find the volume when the pressure is $P = 300\text{N/m}^2$. Find the pressure when the volume is $V = 6\text{m}^3$.

$$V \propto \frac{1}{P} \Rightarrow V = \frac{k}{P}$$

When $V = 3\text{m}^3, P = 400\text{N/m}^2$.

$$V = \frac{k}{P}$$

$$3 = \frac{k}{400} \qquad \Rightarrow V = \frac{1200}{P}$$

$$k = (3)(400) = 1200$$

When $P = 300\text{N/m}^2 \Rightarrow V = \frac{1200}{P} = \frac{1200}{300} = 4\text{m}^3$

When $V = 6\text{m}^3 \Rightarrow V = \frac{1200}{P} \Rightarrow 6 = \frac{1200}{P} \Rightarrow P = \frac{1200}{6} = 200\text{N/m}^2$

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