Exercise 1.1

1 Find the values of the letters p, q and r that make the following pairs of expressions always equal.

(a) $\frac{1}{7}x = \frac{x}{p}$ (b) $\frac{1}{5}(2x+3) = \frac{(2x+3)}{q}$ (c) $\frac{3}{10}(2-7x) = \frac{3(2-7x)}{r}$

2 Solve the following equations.

(a) $\frac{60}{x+4} = 12$ (b) $\frac{35}{2x-3} = 5$ (c) $\frac{20}{6-x} = \frac{1}{2}$

3 Make $\cos C$ the subject of the formula $c^2 = a^2 + b^2 - 2ab\cos C$.

4 (a) Multiply $\frac{x+5}{4}$ by 8. (b) Multiply $(x+2) \div 3$ by 12.

(c) Multiply $\frac{1}{2}(x+7)$ by 6. (d) Multiply $\frac{1}{4}(x-3)$ by 8.

5 Solve the following equations.

(a) $\frac{3}{4}(2x+3) = \frac{5}{8}(x-2)$ (b) $\frac{1}{6}(5x+11) = \frac{2}{3}(2x-4)$

(c) $\frac{5}{9}(3x+1) = \frac{7}{12}(2x+1)$

6 Make x the subject of the following equations.

(a) $\frac{a}{b}(cx+d) = x+2$ (b) $\frac{a}{b}(cx+d) = \frac{2a}{b^2}(x+2d)$

7 Simplify the following as far as possible.

(a) $\frac{a+a+a+a+a}{5}$ (b) $\frac{b+b+b+b}{b}$

(c) $\frac{c \times c \times c \times c \times c}{c}$ (d) $\frac{d \times d \times d \times d}{4}$

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① (a) $\frac{1}{7}x = \frac{x}{p}$ $\therefore \frac{1}{p} = \frac{1}{7}$ $\therefore$ $\underline{p = 7}$

(b) $\frac{1}{5}(2x+3) = \frac{2x+3}{q}$ $\therefore \frac{1}{q} = \frac{1}{5}$ $\therefore$ $\underline{q = 5}$

(c) $\frac{3}{10}(2-7x) = \frac{3(2-7x)}{r}$ $\therefore \frac{3}{10} = \frac{3}{r}$ $\therefore$ $\underline{r = 10}$

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② (a) $\frac{60}{x+4} = 12$

$(\times \text{by } (x+4))$ $\therefore 60 = 12(x+4)$

$(\div 12)$ $\therefore 5 = x+4$

(-4) $\underline{x = 1}$

(b) $\frac{35}{2x-3} = 5$

$(\times \text{by } (2x-3))$ $\therefore 35 = 5(2x-3)$

$(\div 5)$ $7 = 2x-3$

$(+3)$ $2x = 10$

$(\div 2)$ $\underline{x = 5}$

(c) $\frac{20}{6-x} = \frac{1}{2}$

$(\times 2, \times (6-x))$ $40 = 6-x$

$(+x)$ $x+40 = 6$

(-40) $\underline{x = -34}$

(3) $c^2 = a^2 + b^2 - 2ab\cos C$

$\therefore\ c^2 + 2ab\cos C = a^2 + b^2$ $(+2ab\cos C)$

$\therefore\ 2ab\cos C = a^2 + b^2 - c^2$ $(-c^2)$

$\therefore\ \cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$ $(\div 2ab)$

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(4) (a) $\dfrac{(x+5)}{4} \times 8 = \dfrac{2(x+5)}{}$

$= \underline{2x+10}$ } either answer acceptable

(b) $\dfrac{(x+2)}{3} \times 12 = \dfrac{4(x+2)}{}$

$= \underline{4x+8}$ } either answer acceptable

(c) $\frac{1}{2}(x+7) \times 6 = \dfrac{3(x+7)}{}$

$= \underline{3x+21}$ } either answer acceptable

(d) $\frac{1}{4}(x-3) \times 8 = \dfrac{2(x-3)}{}$

$= \underline{2x-6}$ } either answer acceptable

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(5) (a) $\frac{3}{4}(2x+3) = \frac{5}{8}(x-2)$

8 is the LCM of 4 and 8

$(\times 8)\ \therefore\ 6(2x+3) = 5(x-2)$

$\therefore\ 12x + 18 = 5x - 10$

$(-5x, -18)\quad 7x = -28$

$(\div 7)\quad \underline{x = -4}$

(b) $\frac{1}{6}(5x+11) = \frac{2}{3}(x-4)$

6 is the LCM of 6 and 3

$(\times 6)$ $5x+11 = 4(x-4)$

$5x+11 = 4x-16$

$(-4x, -11)$ $x = -27$

(c) $\frac{5}{9}(3x+1) = \frac{7}{12}(2x+1)$

36 is the LCM of 9 and 12

$(\times 36)$ $20(3x+1) = 21(2x+1)$

$60x+20 = 42x+21$

$(-42x, -20)$ $18x = 1$

$(\div 18)$ $x = \frac{1}{18}$

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(6) (a) $\frac{a}{b}(cx+d) = x+2$

$(\times b)$ $a(cx+d) = b(x+2)$

$acx + ad = bx + 2b$

$(-bx, -ad)$ $acx - bx = 2b - ad$

$x(ac-b) = 2b-ad$

$\therefore x = \frac{2b-ad}{ac-b}$

(b) $\frac{a}{b}(cx+d) = \frac{2a}{b^2}(x+2d)$

$(\times b^2)$ $ab(cx+d) = 2a(x+2d)$

$(\div a)$ $b(cx+d) = 2(x+2d)$

} these two steps can be done in either order or at the same time

$bcx + bd = 2x + 4d$

$(-2x, -bd)$ $bcx - 2x = 4d - bd$

$x(bc-2) = 4d - bd$

$(\div(bc-2))$ $x = \frac{4d-bd}{bc-2}$

$\therefore x = \frac{d(4-b)}{bc-2}$

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(7) (a) $\frac{a+a+a+a+a}{5} = \frac{5a}{5} = a$

(b) $\frac{b+b+b+b}{b} = \frac{4b}{b} = 4$

(c) $\frac{c\times c\times c\times c\times c}{c} = \frac{c^5}{c} = c^4$

(d) $\frac{d\times d\times d\times d}{4} = \frac{d^4}{4}$ (or $\frac{1}{4}d^4$)