BASIC

1. Simplify each of the following.

   (a) $\dfrac{45a^2b}{3a}$

   (b) $\dfrac{35c^7d^3}{7cd^4}$

   (c) $\dfrac{64ef^3g^4}{24e^3fg^2}$

   (d) $\dfrac{8h^3jk^4}{(2hjk)^4}$

   (e) $\dfrac{8mn^2x^3}{(4mnx)^2}$

   (f) $\dfrac{9p^3q^4r}{(3pq^2r)^3}$

2. Simplify each of the following.

   (a) $\dfrac{(5a^3b^4)^3}{25ab^3}$

   (b) $\dfrac{(4c^2)^2\,d^3e}{8cde^4}$

   (c) $\dfrac{(7f^2g)^2\,h^4}{21gh}$

   (d) $\dfrac{(2jkl^2)^4}{8j^2k^3}$

3. Simplify each of the following.

   (a) $\dfrac{4a+8b}{6a+12b}$

   (b) $\dfrac{8c^2-16cd}{5c-10d}$

   (c) $\dfrac{e^2+ef}{ef+f^2}$

   (d) $\dfrac{gh-h^2}{(g-h)^2}$

   (e) $\dfrac{j^2-jk}{k^2-jk}$

   (f) $\dfrac{4mn-8m^2}{6m^2}$

4. Simplify each of the following.

   (a) $\dfrac{a^2-b^2}{(a-b)^2}$

   (b) $\dfrac{c^2-4c}{c^2-16}$

   (c) $\dfrac{d^2+4d+4}{d^2+2d}$

   (d) $\dfrac{e-2}{e^2-5e+6}$

   (e) $\dfrac{5f-15}{3f^2-13f+12}$

   (f) $\dfrac{gh+h}{g^2+7g+6}$

5. Simplify each of the following.

(a) $\dfrac{6ab^2}{7c} \times \dfrac{56a^3}{48bc}$

(b) $\dfrac{5a^2b^4}{3bc^4} \times \dfrac{9b^2}{10a^3}$

(c) $\dfrac{4d^2e}{3ef} \times \dfrac{27e^2f^3}{16d^4}$

(d) $\dfrac{16d^2e^4}{7ef^2} \times \dfrac{21e^4f^3}{24d^3e^3}$

(e) $\dfrac{9h^3x^2}{4ky^2} \times \dfrac{5k^2y^4}{12h^2y}$

(f) $\dfrac{16xy^3}{15abc^2} \times \dfrac{25a^3bc}{8x^2yz}$

6. Simplify each of the following.

(a) $\dfrac{2a^2b}{3c} \div \dfrac{3abc}{8c^3}$

(b) $\dfrac{18d^4e^3}{14d^2e} \div \dfrac{27de^5}{21ef^2}$

(c) $\dfrac{14a^3b}{6xy} \div \dfrac{21abc}{12x^2y^3}$

(d) $\dfrac{81a^3x^3}{16bxy} \div \dfrac{63ax^2}{24b^2y^3}$

7. Simplify each of the following.

(a) $\dfrac{4(a+3b)}{a-3b} \times \dfrac{3(a-3b)}{25(a+3b)}$

(b) $\dfrac{7c-28d}{e^2} \times \dfrac{e}{2c-8d}$

(c) $\dfrac{3(g+h)}{10f} \div \dfrac{8g+8h}{5f^3}$

(d) $\dfrac{2(j+k+5)}{9} \div (3j+3k+15)$

8. Express each of the following as a fraction in its simplest form.

(a) $\dfrac{3}{5a} + \dfrac{1}{4a}$

(b) $\dfrac{1}{2b} + \dfrac{3}{4b} - \dfrac{1}{6b}$

(c) $\dfrac{2}{7c} - \dfrac{1}{7d}$

(d) $\dfrac{4ef}{3g} + \dfrac{ef}{g} - \dfrac{2ef}{5g}$

(e) $\dfrac{h+j}{2k} + \dfrac{3h-j}{3k} - \dfrac{j-h}{5k}$

(f) $\dfrac{2(p-q)}{r} + \dfrac{3(p+2q)}{4r} - \dfrac{5(p-4q)}{6r}$

(g) $\dfrac{u}{2v+3} + \dfrac{6u}{4v+6}$

(h) $\dfrac{z+1}{x-2y} - \dfrac{2z-3}{2x-4y} + \dfrac{z}{3x-6y}$

9. Express each of the following as a fraction in its simplest form.

(a) $\dfrac{2}{a} + \dfrac{5}{2(a-1)}$

(b) $\dfrac{2}{3d+1} - \dfrac{1}{5d+3}$

INTERMEDIATE

16. Simplify each of the following.

(a) $\dfrac{(-3a)^2 \, b^3 c}{27abc^4}$

(b) $\dfrac{(-3d^2e^4)^3}{9d^2e^5}$

(c) $\dfrac{(-4fg^3h)^3}{-16f^4gh^5}$

(d) $\dfrac{(-9j^4kl)^3}{(27jkl)^2}$

17. Simplify each of the following.

(a) $\dfrac{(2a-3b)^2}{6a^2-9ab}$

(b) $\dfrac{5c^3d(x+y)}{10c(x+y)^2}$

(c) $\dfrac{15x^3(e-f)^2}{35xy(e-f)^2}$

(d) $\dfrac{g^2+g-6}{g^2-9g+14}$

(e) $\dfrac{6h^2-13h-5}{6h^2+17h+5}$

(f) $\dfrac{6-11k+4k^2}{3k^2+k-14}$

(g) $\dfrac{(p+q)^2-r^2}{(q+r)^2-p^2}$

(h) $\dfrac{(3x+y)^2-4z^2}{15x^2+5xy+10xz}$

(i) $\dfrac{6xz+3yz}{6x^2-2xz+3xy-yz}$

(j) $\dfrac{x^2-2xz+xy-2yz}{x^2+xy-xz-yz}$

(k) $\dfrac{2ac+bc-2ad-bd}{cx-3cy-dx+3dy}$

18. Simplify each of the following.

(a) $\dfrac{2a}{b} \times \dfrac{3c}{4a} \times \dfrac{8a}{9c}$

(b) $\dfrac{3d^2}{ef} \times \dfrac{6e^2}{21ef} \times \dfrac{28f^2}{3de}$

(c) $\dfrac{2}{h^2} \times \dfrac{1}{k^3} \div \dfrac{2h}{3k}$

(d) $\dfrac{4m^2n^4}{36m} \times \dfrac{24m}{8m^2n^3} \div \dfrac{16m}{6mn^2}$

(e) $\dfrac{3p^3q^3}{8r^4} \times \dfrac{6q^2r^3}{5p^5} \div \dfrac{9q^2}{10pr}$

(f) $\dfrac{2x^2y^3}{7az^3} \div \dfrac{4x^2z}{21a^2z} \times \dfrac{3a}{8xy}$

(g) $\dfrac{9b}{21c} \div \left(\dfrac{3d}{4e} \times \dfrac{16be}{9a} \right)$

(h) $\dfrac{3x}{4y} \div \left(\dfrac{7x^2}{15z} \div \dfrac{3y^2}{10z^2} \right)$

19. Simplify each of the following.

(a) $\dfrac{x^5-x^4}{ax-a} \div \dfrac{ax^2}{ax-x}$

(b) $\dfrac{x}{x+1} \div \dfrac{x^2-2x}{x^2-2x-3}$