

METHOD #1

$$\textcircled{1} \frac{\frac{3}{2} - 1 \cdot \frac{2}{2}}{\frac{5}{6} - \frac{2}{3} \cdot \frac{2}{2}}$$

$$\frac{\frac{3}{2} - \frac{2}{2}}{\frac{5}{6} - \frac{4}{6}}$$

$$\frac{\frac{1}{2}}{\frac{1}{6}}$$

$$\frac{1}{2} \div \frac{1}{6}$$

$$\frac{1}{2} \cdot \frac{6}{1} = \boxed{3}$$

$$\textcircled{2} \frac{\frac{5}{5} \cdot 1 + \frac{2}{5}}{\frac{5}{5} \cdot \frac{5}{2} - \frac{2}{5} \cdot \frac{2}{2}}$$

$$\frac{\frac{5}{5} + \frac{2}{5}}{\frac{25}{10} - \frac{4}{10}}$$

$$\frac{\frac{7}{5}}{\frac{21}{10}}$$

$$\frac{7}{5} \div \frac{21}{10}$$

$$\frac{7}{5} \cdot \frac{10}{21} = \boxed{\frac{2}{3}}$$

$$\textcircled{4} \frac{\frac{4}{4} \cdot \frac{4}{9} + \frac{1}{4} \cdot \frac{9}{9}}{\frac{3}{3} \cdot 2 - \frac{1}{3}}$$

$$\frac{\frac{16}{36} + \frac{9}{36}}{\frac{6}{3} - \frac{1}{3}}$$

$$\frac{\frac{25}{36}}{\frac{5}{3}}$$

$$\frac{25}{36} \div \frac{5}{3}$$

$$\frac{5}{12} \cdot \frac{3}{5} = \boxed{\frac{5}{12}}$$

$$\textcircled{5} \frac{\frac{1}{x}}{\frac{1}{y}}$$

$$\frac{1}{x} \div \frac{1}{y}$$

$$\frac{1}{x} \cdot \frac{y}{1} = \boxed{\frac{y}{x}}$$

$$\textcircled{7} \frac{a-1}{\frac{a}{a} \cdot 1 - \frac{1}{a}}$$

$$\frac{a-1}{\frac{a-1}{a}}$$

$$\frac{a-1}{\frac{a-1}{a}}$$

$$a-1 \div \frac{a-1}{a}$$

$$a-1 \cdot \frac{a}{a-1}$$

$$\frac{a-1}{1} \cdot \frac{a}{a-1} = \boxed{a}$$

METHOD #1

$$\textcircled{8} \frac{\frac{c}{c} \cdot c - \frac{1}{c}}{\frac{c}{c} \cdot 1 + \frac{1}{c}}$$

$$\frac{\frac{c^2}{c} - \frac{1}{c}}{\frac{c}{c} + \frac{1}{c}}$$

$$\frac{\frac{c^2-1}{c}}{\frac{c+1}{c}}$$

$$\frac{c^2-1}{c} \div \frac{c+1}{c}$$

$$\frac{\cancel{c+1}(c-1)}{\cancel{c+1}} \cdot \frac{\cancel{c}}{\cancel{c+1}} = \boxed{c-1}$$

$$\textcircled{9} \frac{\frac{z+1}{z+1} \cdot 1 + \frac{1}{z+1}}{\frac{z-1}{z-1} \cdot 1 + \frac{3}{z-1}}$$

$$\frac{\frac{z+1}{z+1} + \frac{1}{z+1}}{\frac{z-1}{z-1} + \frac{3}{z-1}}$$

$$\frac{\frac{z+2}{z+1}}{\frac{z+2}{z-1}}$$

$$\frac{z+2}{z+1} \div \frac{z+2}{z-1}$$

$$\frac{\cancel{z+2}}{\cancel{z+1}} \cdot \frac{\cancel{z-1}}{\cancel{z+2}} = \boxed{\frac{z-1}{z+1}}$$

$$\textcircled{10} \frac{r^{-2} + 1}{r-1}$$

$$\frac{\frac{1}{r^2} + 1 \cdot \frac{r^2}{r^2}}{r-1}$$

$$\frac{\frac{1+r^2}{r^2}}{r-1}$$

$$\frac{\frac{1+r^2}{r^2}}{r-1}$$

$$\frac{1+r^2}{r^2} \div r-1$$

$$\frac{1+r^2}{r^2} \cdot \frac{1}{r-1} = \boxed{\frac{1+r^2}{r^2(r-1)}}$$

$$\textcircled{13} \frac{9 - k^{-2}}{3k^{-1} - k^{-2}}$$

$$\frac{\frac{k^2}{k^2} \cdot 9 - \frac{1}{k^2}}{\frac{k}{k} \cdot \frac{3}{k} - \frac{1}{k^2}}$$

$$\frac{\frac{9k^2}{k^2} - \frac{1}{k^2}}{\frac{3k}{k^2} - \frac{1}{k^2}}$$

$$\frac{\frac{9k^2-1}{k^2}}{\frac{3k-1}{k^2}}$$

$$\frac{9k^2-1}{k^2} \div \frac{3k-1}{k^2}$$

$$\frac{\cancel{k^2}(9k+1)\cancel{k^2}}{\cancel{k^2}} \cdot \frac{\cancel{k^2}}{\cancel{3k-1}} = \boxed{3k+1}$$

METHOD #2

$$\textcircled{1} \quad \frac{\frac{3}{2} - 1}{\frac{5}{6} - \frac{2}{3}} \cdot \frac{6}{6}$$

$$\frac{9-6}{5-4} = \frac{3}{1}$$

$$\textcircled{2} \quad \frac{1 + \frac{2}{5}}{\frac{5}{2} - \frac{2}{5}} \cdot \frac{10}{10}$$

$$\frac{10+4}{25-4} = \frac{14}{21} = \frac{2}{3}$$

$$\textcircled{4} \quad \frac{\frac{4}{9} + \frac{1}{4}}{2 - \frac{1}{3}} \cdot \frac{36}{36}$$

$$\frac{16+9}{72-12} = \frac{25}{60} = \frac{5}{12}$$

$$\textcircled{5} \quad \frac{\frac{1}{x}}{\frac{1}{y}} \cdot \frac{xy}{xy} = \frac{y}{x}$$

$$\textcircled{7} \quad \frac{a-1}{1-\frac{1}{a}} \cdot \frac{a}{a}$$

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

$$\textcircled{8} \quad \frac{c - \frac{1}{c}}{1 + \frac{1}{c}} \cdot \frac{c}{c}$$

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

$$\textcircled{10} \quad \frac{1 + \frac{1}{z+1}}{1 + \frac{3}{z-1}} \cdot \frac{(z+1)(z-1)}{(z+1)(z-1)}$$

$$\frac{(z+1)(z-1) + z-1}{(z+1)(z-1) + 3(z+1)}$$

$$\frac{z^2-1+z-1}{z^2-1+3z+3}$$

$$\frac{z^2+z-2}{z^2+3z+2}$$

$$\frac{(z+2)(z-1)}{(z+2)(z+1)} = \frac{z-1}{z+1}$$

$$\textcircled{11} \quad \frac{\frac{1}{r^2} + 1}{r-1} \cdot \frac{r^2}{r^2}$$

$$\frac{1+r^2}{r^3-r^2}$$

$$\frac{1+r^2}{r^2(r-1)}$$

METHOD #2

$$\textcircled{B} \frac{9 - \frac{1}{k^2}}{\frac{3}{k} - \frac{1}{k^2}} \cdot \frac{k^2}{k^2}$$

$$\frac{9k^2 - 1}{3k - 1}$$

$$\frac{(3k+1)(3k-1)}{3k-1}$$

$$\boxed{3k+1}$$