1. $\dfrac{a^3+3a^2+3a+1}{a^2+2a+1} \cdot \dfrac{2a-2}{1-a^2}$

$$= \frac{(a+1)^3}{(a+1)^2} \cdot \frac{2(a-1)}{-(a-1)(a+1)} = -2 \qquad\qquad C.E.: a \neq \pm 1$$

2. $\left[\left(\dfrac{a}{a^2-a-6} + \dfrac{1}{a^2-9} \right) \cdot \dfrac{a-3}{a^2+4a+2} + \dfrac{1}{a+3} \right] (4a+8)$

$$= \left[\left(\frac{a}{(a-3)(a+2)} + \frac{1}{(a-3)(a+3)} \right) \cdot \frac{a-3}{a^2+4a+2} + \frac{1}{a+3} \right] 4(a+2) = \qquad C.E.: \begin{cases} a \neq \pm 3 \\ a \neq -2 \\ a^2+4a+2 \neq 0 \end{cases}$$

$$= \left[\frac{a(a+3)+a+2}{(a-3)(a+3)(a+2)} \cdot \frac{a-3}{a^2+4a+2} + \frac{1}{a+3} \right] 4(a+2) =$$

$$= \left(\frac{a^2+4a+2}{(a-3)(a+3)(a+2)} \cdot \frac{a-3}{a^2+4a+2} + \frac{1}{a+3} \right) 4(a+2) =$$

$$= \left(\frac{1}{(a+3)(a+2)} + \frac{1}{a+3} \right) 4\,(a+2) = \frac{1+a+2}{(a+3)(a+2)} \cdot 4(a+2) = \frac{a+3}{(a+3)(a+2)} \cdot 4\,(a+2) = 4$$

3. $\left(\dfrac{x-3}{3x-3} - \dfrac{1}{1-x^2} \right) \left(\dfrac{1}{x} + 2 + x \right) \cdot \dfrac{3}{x-2} \cdot (x-1) - x - 9$

$$= \left(\frac{x-3}{3(x-1)} - \frac{1}{-(x-1)(x+1)} \right) \left(\frac{1+2x+x^2}{x} \right) \cdot \frac{3}{x-2} \cdot (x-1) - x - 9 = \qquad C.E.: \begin{cases} x \neq 0 \\ x \neq \pm 1 \\ x \neq 2 \end{cases}$$

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

$$= \frac{x^2-3x+x-3+3}{x\,(x-2)} \cdot (x+1) - x - 9 =$$

$$= \frac{x^2-2x}{x(x-2)} \cdot (x+1) - x - 9 = \frac{x(x-2)}{x(x-2)} \cdot (x+1) - x - 9 = x+1-x-9 = -8$$

4. $\dfrac{(16a-32)(a^2-1)}{a^3-1}\left(\dfrac{1}{2a^2-3a-2}-\dfrac{1}{a^3+a^2-4a-4}\right)(2a^2+5a+2)$

$= \dfrac{16(a-2)(a+1)(a-1)}{(a-1)(a^2+a+1)}\left(\dfrac{1}{2a^2-4a+a-2}-\dfrac{1}{a^2(a+1)-4(a+1)}\right)(2a^2+4a+a+2) = \qquad C.E.:\begin{cases} a \neq \pm 1 \\ a \neq \pm 2 \\ a \neq -\dfrac{1}{2} \end{cases}$

$= \dfrac{16\,(a-2)(a+1)}{a^2+a+1}\left(\dfrac{1}{2a\,(a-2)+(a-2)}-\dfrac{1}{(a+1)(a^2-4)}\right)[2a\,(a+2)+1\,(a+2)] =$

$= \dfrac{16\,(a-2)(a+1)}{a^2+a+1}\left(\dfrac{1}{(a-2)(2a+1)}-\dfrac{1}{(a+1)(a-2)(a+2)}\right)(a+2)(2a+1) =$

$= \dfrac{16\,(a-2)(a+1)}{a^2+a+1}\cdot\dfrac{(a+1)(a+2)-(2a+1)}{(2a+1)(a-2)(a+2)(a+1)}\cdot(a+2)(2a+1) =$

$= \dfrac{16}{a^2+a+1}\cdot(a^2+2a+a+2-2a-1) = \dfrac{16}{a^2+a+1}\cdot(a^2+a+1) = \mathbf{16}$