`>` $qr := simplify(sum((1 + 14*k^2 + k^4)^3 / (k^2 * (1 - k^2)^4), k = 2..n));$

$$qr := \frac{(n+1)^3}{3} - \frac{(n+1)^2}{2} + \frac{277\,n}{6} - \frac{287}{6} + \frac{-64\,n^3 + 321\,n^2 - 512\,n + 256}{n^4}$$

$$- \frac{64\,n\,(n-1)^2}{(n+1)^4} - 641\,\Psi(1,n) - \frac{256\,\Psi(3,n)}{3} + \frac{641\,\pi^2}{6} + \frac{256\,\pi^4}{45} \qquad (1)$$

`>`
`>`

`>` # fixing polygamma and pi parts manually

$$qr := simplify\left(\frac{(n+1)^3}{3} - \frac{(n+1)^2}{2} + \frac{277\,n}{6} - \frac{287}{6} \right.$$

$$\left. + \frac{-64\,n^3 + 321\,n^2 - 512\,n + 256}{n^4} - \frac{64\,n\,(n-1)^2}{(n+1)^4} - \frac{512}{n^4} - \frac{641}{n^2} \right);$$

$$insert\_n\_in\_qr := subs\left(n = -\frac{1}{2}, qr \right);$$

$$qr := \frac{1}{6\,n^4\,(n+1)^4}\left(2\,n^{11} + 11\,n^{10} + 301\,n^9 + 846\,n^8 - 244\,n^7 - 3305\,n^6 - 14315\,n^5 \right.$$

$$\left. - 27168\,n^4 - 32640\,n^3 - 23424\,n^2 - 9216\,n - 1536 \right)$$

$$insert\_n\_in\_qr := -71 \qquad (2)$$

`>` $main := simplify(sum((1 + 14*k + k^2)^3 / (k*(1-k)^4), k = 2..n));$

$$main := \frac{(n+1)^2}{2} + \frac{91\,n}{2} - \frac{97}{2} + \frac{1}{n} + 4096\,\Psi(2,n) - 4864\,\Psi(1,n) - \frac{2048\,\Psi(3,n)}{3} \qquad (3)$$

$$+ 769\,\Psi(n) + 8192\,\zeta(3) + \frac{2432\,\pi^2}{3} + \frac{2048\,\pi^4}{45} + 769\,\gamma$$

fixing zeta, gamma, polygamma and pi parts manually

`>` $main := \frac{(n+1)^2}{2} + \frac{91\,n}{2} - \frac{97}{2} + \frac{1}{n} - \frac{4096}{n^4} - \frac{8192}{n^3} - \frac{4864}{n^2} - \frac{769}{n};$

$$main := \frac{(n+1)^2}{2} + \frac{91\,n}{2} - \frac{97}{2} - \frac{768}{n} - \frac{4096}{n^4} - \frac{8192}{n^3} - \frac{4864}{n^2} \qquad (4)$$

`>`

`>` $insert\_n\_in\_main := subs(n = -2, main)$

$$insert\_n\_in\_main := -203 \qquad (5)$$

`>`
`>`