

NÚMEROS ENTEROS Y RACIONALES

1. Realiza las siguientes operaciones:

a) $2 \cdot (3 - 9) - 6 \cdot (5 - 6) - 4 \cdot (8 - 9) = 2 \cdot (-6) - 6 \cdot (-1) - 4 \cdot (-1) = (-12) - (-6) - (-4) = -12 + 6 + 4 = -2$

b) $-5 \cdot (-3 - 2) + 2 \cdot (12 - 13) - (-9) = -5 \cdot (-5) + 2 \cdot (-1) - (-9) = (+30) + (-2) - (-9) = 25 - 2 + 9 = 32$

c) $2 \cdot (3 - 4 + 2) - (-15) + (13 - 8) \cdot 5 = 2 \cdot (+1) - (-15) + (+5) \cdot 5 = (+2) - (-15) + (+25) = +2 + 15 + 25 = 42$

d) $(-2 - 4) \cdot (-1 + 3) - (-15 - 2) : (-9 + 8) = (-6) \cdot (+2) - (-17) : (-1) = (-12) - (+17) = -12 - 17 = -29$

e) $4 - 3 \cdot [2 + 4 \cdot (1 - 7)] + 6 - (-5) = 4 - 3 \cdot [2 + 4 \cdot (-6)] + 6 + 5 = 4 - 3 \cdot [2 + (-24)] + 6 + 5 =$
 $4 - 3 \cdot [2 - 24] + 6 + 5 = 4 - 3 \cdot (-22) + 6 + 5 = 4 - (-66) + 6 + 5 = 4 + 66 + 6 + 5 = 81$

f) $(-13) \cdot (-2 + 3) - (-8) + 15 : (-3 - 2) = (-13) \cdot (+1) - (-8) + 15 : (-5) = -13 - (-8) + (-3) =$
 $= -13 + 8 - 3 = -8$

g) $18 - 3 \cdot (12 - 15) + 3 \cdot (6 - 4) \cdot (5 - 9) = 18 - 3 \cdot (-3) + 3 \cdot 2 \cdot (-4) = 18 - (-9) + (-24) = 18 + 9 - 24 = 3$

h) $(8 - 4) \cdot (5 - 8) : (6 - 9) - (-2 - 8) \cdot (10 - 4) = 4 \cdot (-3) : (-3) - (-10) \cdot 6 = 4 - (-60) = 4 + 60 = 64$

i) $26 - 5 \cdot [10 + 4 \cdot (5 - 6)] = 26 - 5 \cdot [10 + 4 \cdot (-1)] = 26 - 5 \cdot [10 + (-4)] = 26 - 5 \cdot [10 - 4] =$
 $= 26 - 5 \cdot 6 = 26 - 30 = -4$

j) $(-9) \cdot (8 - 3) - 6 \cdot [2 - (6 - 8) \cdot 4] = (-9) \cdot (+5) - 6 \cdot [2 - (-2) \cdot 4] = -45 - 6 \cdot [2 - (-8)] = -45 - 6 \cdot [2 + 8] =$
 $= -45 - 6 \cdot 10 = -45 - 60 = -105$

k) $2 \cdot [-22 + 5 \cdot (4 - 2 \cdot 5)] + 18 = 2 \cdot [-22 + 5 \cdot (4 - 10)] + 18 = 2 \cdot [-22 + 5 \cdot (-6)] + 18 = 2 \cdot [-22 - 30] + 18 =$
 $= 2 \cdot [-52] + 18 = -104 + 18 = -86$

l) $[6 + 2 \cdot (3 - 25 : 5)] - [4 - 3 \cdot (8 - 6)] = [6 + 2 \cdot (3 - 5)] - [4 - 3 \cdot 2] = [6 + 2 \cdot (-2)] - [4 - 6] =$
 $= (6 - 4) - (-2) = 2 + 2 = 4$

m) $[3 + 5 \cdot (8 - 9)] - (-6) - [7 - 4 \cdot (15 : 3 - 3)] = [3 + 5 \cdot (-1)] + 6 - [7 - 4 \cdot (5 - 3)] = [3 + (-5)] + 6 - [7 - 4 \cdot 2] =$
 $= (3 - 5) + 6 - (7 - 8) = -2 + 6 - (-1) = -2 + 6 + 1 = 5$

n) $2 \cdot (-3) \cdot 4 \cdot (-5) : (-6) + 2^2 = (-6) \cdot 4 \cdot (-5) : (-6) + 4 = -24 \cdot (-5) : (-6) + 4 = 120 : (-6) + 4 =$
 $= -20 + 4 = -16$

o) $2^2 \cdot [(-3)^2 - (6 - 8)^3] + (-4) : (-2)^1 = 4 \cdot [9 - (-2)^3] + (-4) : (-2) = 4 \cdot [9 - (-8)] + 2 = 4 \cdot (9 + 8) + 2 =$
 $= 4 \cdot 17 + 2 = 68 + 2 = 70$

2. Realiza las siguientes operaciones:

- a)** $-5 + 4 \cdot (-2 + 1)^3 - 6 \cdot (5 - 6)^4 - (-4) \cdot (12 - 9)^2 = -5 + 4 \cdot (-1)^3 - 6 \cdot (-1)^4 - (-4) \cdot (+3)^2 =$
 $= -5 + 4 \cdot (-1) - 6 \cdot (+1) - (-4) \cdot (+9) = -5 + (-4) - (+6) - (-36) = -5 - 4 - 6 + 36 = 21$
- b)** $(3 - 4)^4 - (-2)^3 + 18 : (-1 - 8) - (-4 + 2)^2 = (-1)^4 - (-8) + 18 : (-9) - (-2)^2 = +1 + 8 + (-2) - (+4) =$
 $= +1 + 8 - 2 - 4 = 3$
- c)** $12 - 8 \cdot [-2 - 3 + (-2)^2 - 3^2] - (5 - 6)^5 - \sqrt{9} \cdot (8 - 9) = 12 - 8 \cdot [-2 - 3 + 4 - 9] - (-1)^5 - 3 \cdot (-1) =$
 $= 12 - 8 \cdot (-10) - (-1) - (-3) = 12 - (-80) + 1 + 3 = 12 + 80 + 1 + 3 = 96$
- d)** $12 : (-6) + (-8 - 7) \cdot (-3 - 2 + 6) - (-3) \cdot (-4) = -2 + (-15) \cdot 1 - 12 = -2 + (-15) - 12 = -12 - 15 - 12 = -29$
- e)** $(-40) : (-2)^3 + \sqrt{36} \cdot (6 - 2 \cdot 5) + (-15) : (-3) = (-40) : (-8) + 6 \cdot (6 - 10) + 5 = 5 + 6 \cdot (-4) + 5 =$
 $= 5 - 24 + 5 = -14$
- f)** $(-5)^3 : [1 + (-2)^3 \cdot (-3)] - 4 \cdot (-10)^2 = -125 : [1 + (-8) \cdot (-3)] - 4 \cdot 100 = -125 : [1 + 24] - 400 =$
 $= -125 : 25 - 400 = -5 - 400 = -405$
- g)** $3 \cdot [5 - 3 \cdot (6 - 2 \cdot 5 + 24 : 2) + (-3)^3] - (-3 - 1)^1 = 3 \cdot [5 - 3 \cdot (6 - 10 + 12) + (-27)] - (-4)^1 =$
 $= 3 \cdot [5 - 3 \cdot 8 - 27] - (-4) = 3 \cdot [5 - 24 - 27] + 4 = 3 \cdot (-46) + 4 = -138 + 4 = -134$
- h)** $(-3) \cdot (-5)^2 - [4 + 2^5 - 3^2 \cdot (-2)^2] - (-1)^{10} = (-3) \cdot (+25) - [4 + 32 - 9 \cdot (+4)] - (+1) =$
 $= (-75) - [4 + 32 - 36] - 1 = -75 - 0 - 1 = -76$
- i)** $(-3)^2 \cdot [4 - (-6 + 8 \cdot (-5))] - 4 \cdot (-1 - 3)^0 = (+9) \cdot [4 - (-6 + (-40))] - 4 \cdot (-4)^0 = 9 \cdot [4 - (-6 - 40)] - 4 \cdot 1 =$
 $= 9 \cdot [4 - (-46)] - 4 = 9 \cdot (4 + 46) - 4 = 9 \cdot 50 - 4 = 450 - 4 = 446$
- j)** $5 - 3 \cdot (12 - 7)^2 - [24 : (2 - \sqrt{36})] = 5 - 3 \cdot 5^2 - [24 : (2 - 6)] = 5 - 3 \cdot 25 - (24 : (-4)) = 5 - 75 - (-6) =$
 $= 5 - 75 + 6 = -64$
- k)** $-12 : (-7 + 3) - (-9 - 3) : (-3) + (-20) : (6 - 7)^1 = -12 : (-4) - (-12) : (-3) + (-20) : (-1)^1 =$
 $= -12 : (-4) - (-12) : (-3) + (-20) : (-1)^1 = 3 - 4 + 20 = 19$
- l)** $[\sqrt{144} - (-2)^2 + (-5)^1]^2 : [(-7)^2 - (-1) - (+41)] = [12 - 4 + (-5)]^2 : [49 + 1 - 41] = [12 - 4 - 5]^2 : 9 =$
 $= 3^2 : 9 = 9 : 9 = 1$
- m)** $(5 - 8)^3 \cdot (-2)^2 + (-4 - 2) : (-3)^1 - [45 - (-8)] \cdot (-3 + 2)^7 = (-3)^3 \cdot 4 + (-6) : (-3) - [45 + 8] \cdot (-1)^7 =$
 $= -27 \cdot 4 + 2 - 53 \cdot (-1) = -108 + 2 + 53 = -53$
- n)** $\sqrt{25} - [34 + 55 : (-13 + 2)] - (13 - 9 \cdot 2) \cdot (-2 + 1)^3 = 5 - [34 + 55 : (-11)] - (13 - 18) \cdot (-1)^3 =$
 $= 5 - [34 - 5] - (-5) \cdot (-1) = 5 - 29 - 5 = -29$

- o) $2^4 : (-2)^3 + (-12 - 18) : (-16 + 3 \cdot \sqrt{4}) = 16 : (-8) + (-30) : (-16 + 3 \cdot 2) = -2 + (-30) : (-16 + 6) = -2 + (-30) : (-10) = -2 + 3 = 1$
- p) $[(6 - 11) \cdot (-3)] : [-25 : (2 - (-3) \cdot (-9))] = [(-5) \cdot (-3)] : [-25 : (2 - 27)] = 15 : [-25 : (-25)] = 15 : 1 = 15$
- q) $(-5)^3 : (2^0 - 6) + \sqrt[3]{8} \cdot [(-3 - 1)^2 + \sqrt[3]{-8}] - (-3)^1 = -125 : (1 - 6) + 2 \cdot [(-4)^2 + (-2)] - (-3) = -125 : (-5) + 2 \cdot [16 - 2] + 3 = 25 + 2 \cdot 14 + 3 = 25 + 28 + 3 = 56$
- r) $(2 - 5)^4 : (1 - 4 \cdot 7) - 2 \cdot (\sqrt{64} : (-4) + 1) - (-27) : (8^1 + 5^0) = (-3)^4 : (1 - 28) - 2 \cdot (8 : (-4) + 1) - (-27) : (8 + 1) = 81 : (-27) - 2 \cdot (-2 + 1) - (-27) : 9 = -3 - 2 \cdot (-1) - (-3) = -3 + 2 + 3 = 2$
- s) $(-8 + 6)^4 \cdot [(-9 + 4 + 13) : (-5 + 3 \cdot 2) - (-2)^3] - (-9 + 6 \cdot 3) \cdot (-6 + 8) = (-2)^4 \cdot [8 : (-5 + 6) - (-8)] - (-9 + 18) \cdot 2 = 16 \cdot [8 : 1 + 8] - 9 \cdot 2 = 16 \cdot (8 + 8) - 18 = 16 \cdot 16 - 18 = 256 - 18 = 238$
- t) $(-2)^5 : [(-8) : (-4) - \sqrt{9} \cdot (-2)] - [(-18) : 9 + (-3 + 5)^0] = -32 : [2 - 3 \cdot (-2)] - [2 + (-2)^0] = -32 : (2 + 6) - (-2 + 1) = -32 : 8 - (-1) = -4 + 1 = -3$

3. Calcula y simplifica:

- a) $\frac{4}{3} : \left(\frac{1}{3} + \frac{2}{6}\right) - \frac{3}{4} \underset{\text{paréntesis}}{=} \frac{4}{3} : \left(\frac{2}{6} + \frac{2}{6}\right) - \frac{3}{4} = \frac{4}{3} : \left(\frac{4}{6}\right) - \frac{3}{4} \underset{\text{simplificar}}{=} \frac{4}{3} : \frac{2}{3} - \frac{3}{4} \underset{\text{división}}{=} \frac{12}{6} - \frac{3}{4} \underset{\text{simplificar}}{=} 2 - \frac{3}{4} = \frac{8 - 3}{4} = \frac{5}{4}$
- b) $\frac{5}{11} \cdot \left(\frac{1}{2} - \frac{1}{10}\right) + \frac{3}{5} \cdot \left(1 + \frac{4}{11}\right) \underset{\text{paréntesis}}{=} \frac{5}{11} \cdot \left(\frac{5}{10} - \frac{1}{10}\right) + \frac{3}{5} \cdot \left(\frac{11 + 4}{11}\right) = \frac{5}{11} \cdot \left(\frac{4}{10}\right) + \frac{3}{5} \cdot \left(\frac{15}{11}\right) \underset{\text{simplificar}}{=} \frac{5}{11} \cdot \frac{2}{5} + \frac{3}{5} \cdot \frac{15}{11} = \frac{5 \cdot 2}{11 \cdot 5} + \frac{3 \cdot 3 \cdot 5}{5 \cdot 11} = \frac{2}{11} + \frac{9}{11} = \frac{11}{11} = 1$
- c) $\frac{4}{10} : \frac{2}{3} - \frac{4}{5} \cdot \frac{2}{3} + \frac{5}{3} - \frac{1}{4} : \frac{3}{5} = \frac{12}{20} - \frac{8}{15} + \frac{5}{3} - \frac{5}{12} = \frac{36 - 32 + 100 - 25}{60} = \frac{79}{60}$
- d) $\frac{2}{5} : \left(\frac{1}{5} - \frac{3}{10}\right) + \left(\frac{1}{4} - \frac{1}{2}\right) = \frac{2}{5} : \left(\frac{2}{10} - \frac{3}{10}\right) + \left(\frac{1}{4} - \frac{2}{4}\right) = \frac{2}{5} : \left(-\frac{1}{10}\right) + \left(-\frac{1}{4}\right) = -\frac{20}{5} - \frac{1}{4} = -4 - \frac{1}{4} = \frac{-16 - 1}{4} = -\frac{17}{4}$
- e) $\frac{3}{2} + \frac{3}{4} \cdot \left(\frac{1}{3}\right)^2 - \sqrt{\frac{9}{16}} = \frac{3}{2} + \frac{3}{4} \cdot \frac{1}{9} - \frac{3}{4} \underset{\text{producto y simplificar}}{=} \frac{3}{2} + \frac{3 \cdot 1}{4 \cdot 3 \cdot 3} - \frac{3}{4} = \frac{3}{2} + \frac{1}{12} - \frac{3}{4} = \frac{18 + 1 - 9}{12} = \frac{10}{12} \underset{\text{simplificar}}{=} \frac{5}{6}$

$$\text{f)} \quad \frac{6}{10} : \frac{2}{3} - \frac{4}{5} \cdot \frac{4}{3} + \frac{1}{3} - \frac{3}{4} : \frac{3}{7} \underset{\substack{\text{producto y cociente} \\ \text{y simplificar}}}{=} \frac{2 \cdot 3 \cdot 3}{2 \cdot 5 \cdot 2} - \frac{16}{15} + \frac{1}{3} - \frac{3 \cdot 7}{4 \cdot 3} = \frac{9}{10} - \frac{16}{15} + \frac{1}{3} - \frac{7}{4} = \frac{54 - 64 + 20 - 105}{60} =$$

$$= -\frac{95}{60} \underset{\text{simplificar}}{=} -\frac{19}{12}$$

$$\text{g)} \quad \frac{4}{10} : \left(\frac{2}{3} - \frac{1}{5} \right) \cdot \frac{2}{3} + \frac{5}{3} - \frac{1}{4} : \frac{3}{5} = \frac{2}{5} : \left(\frac{10}{15} - \frac{3}{15} \right) \cdot \frac{2}{3} + \frac{5}{3} - \frac{5}{12} = \frac{2}{5} : \frac{7}{15} \cdot \frac{2}{3} + \frac{5}{3} - \frac{5}{12} = \frac{2 \cdot 3 \cdot 5}{5 \cdot 7} \cdot \frac{2}{3} + \frac{5}{3} - \frac{5}{12} =$$

$$= \frac{2 \cdot 3 \cdot 5 \cdot 2}{5 \cdot 7 \cdot 3} + \frac{5}{3} - \frac{5}{12} = \frac{4}{7} + \frac{5}{3} - \frac{5}{12} = \frac{48 + 140 - 35}{84} = \frac{153}{84} = \frac{51}{28}$$

$$\text{h)} \quad \left(\frac{2}{3} - \frac{7}{2} - \frac{5}{6} + \frac{1}{4} \right) + \left(-\frac{4}{3} + \frac{2}{3} - \sqrt{\frac{1}{(-6)^2}} \right)^2 = \left(\frac{8 - 42 - 10 + 3}{12} \right) + \left(-\frac{4}{3} + \frac{2}{3} - \sqrt{\frac{1}{36}} \right)^2 = \left(-\frac{41}{12} \right) + \left(-\frac{4}{3} + \frac{2}{3} - \frac{1}{6} \right)^2 =$$

$$= \left(-\frac{41}{12} \right) + \left(\frac{-8 + 4 - 1}{6} \right)^2 = -\frac{41}{12} + \left(\frac{-5}{6} \right)^2 = -\frac{41}{12} + \frac{25}{36} = \frac{-123 + 25}{36} = -\frac{98}{36} = -\frac{49}{18}$$

$$\text{i)} \quad \frac{4}{10} \cdot \left(\frac{2}{3} - \frac{1}{5} \right) + \frac{2}{3} : \frac{5}{3} - \frac{1}{4} \cdot \frac{3}{5} = \frac{2}{5} \cdot \left(\frac{10}{15} - \frac{3}{15} \right) + \frac{6}{15} - \frac{3}{20} = \frac{2}{5} \cdot \frac{7}{15} + \frac{2}{5} - \frac{3}{20} = \frac{14}{75} + \frac{2}{5} - \frac{3}{20} = \frac{56 + 120 - 45}{300} =$$

$$= \frac{131}{300}$$

$$\text{j)} \quad \frac{\frac{1}{2} - \left(\frac{3}{4} - 1 \right)}{\frac{3}{4} + 1} = \frac{\frac{1}{2} - \left(\frac{3}{4} - \frac{4}{4} \right)}{\frac{3}{4} + \frac{4}{4}} = \frac{\frac{1}{2} - \left(-\frac{1}{4} \right)}{\frac{7}{4}} = \frac{\frac{1}{2} + \frac{1}{4}}{\frac{7}{4}} = \frac{\frac{2}{4} + \frac{1}{4}}{\frac{7}{4}} = \frac{\frac{3}{4}}{\frac{7}{4}} = \frac{3}{4} : \frac{7}{4} = \frac{3 \cdot 4}{4 \cdot 7} = \frac{3}{7}$$

$$\text{k)} \quad \frac{\left(\frac{2}{3} - \frac{5}{9} \right) \cdot \left(\frac{3}{4} - \frac{5}{6} \right)}{\left(\frac{7}{12} - \frac{5}{6} \right) \cdot \frac{4}{3} + 1} = \frac{\left(\frac{6}{9} - \frac{5}{9} \right) \cdot \left(\frac{9}{12} - \frac{10}{12} \right)}{\left(\frac{7}{12} - \frac{10}{12} \right) \cdot \frac{4}{3} + 1} = \frac{\left(\frac{1}{9} \right) \cdot \left(-\frac{1}{12} \right)}{\left(-\frac{3}{12} \right) \cdot \frac{4}{3} + 1} = \frac{-\frac{1}{108}}{\left(-\frac{1}{4} \right) \cdot \frac{4}{3} + 1} = \frac{-\frac{1}{108}}{-\frac{1}{3} + 1} = \frac{-\frac{1}{108}}{\frac{2}{3}} = -\frac{1}{108} : \frac{2}{3} =$$

$$= -\frac{3}{108 \cdot 2} - \frac{3}{3 \cdot 36 \cdot 2} = -\frac{1}{72}$$

$$\text{l)} \quad \frac{\frac{2}{5} - \frac{6}{3} + \frac{2}{3}}{1 - \frac{2}{5} - \frac{6}{4}} - \frac{\frac{1}{2} + \frac{1}{3}}{\frac{2}{2} + \frac{6}{5}} = \frac{\frac{6 - 30 + 10}{15}}{\frac{20 - 8 - 30}{20}} - \frac{\frac{3 + 2}{6}}{\frac{10 + 18}{15}} = \frac{-\frac{14}{15}}{\frac{-18}{20}} - \frac{\frac{5}{6}}{\frac{28}{15}} = \left(-\frac{14}{15} : \frac{-9}{10} \right) - \left(\frac{5}{6} : \frac{28}{15} \right) =$$

$$= \left(\frac{14 \cdot 10}{15 \cdot 9} \right) - \left(\frac{5 \cdot 15}{6 \cdot 28} \right) = \left(\frac{14 \cdot 2 \cdot 5}{3 \cdot 5 \cdot 9} \right) - \left(\frac{5 \cdot 3 \cdot 5}{2 \cdot 3 \cdot 28} \right) = \frac{28}{27} + \frac{25}{56} = \frac{1568 - 675}{1512} = \frac{893}{1512}$$

$$\text{m)} \quad \frac{5}{3} \cdot \left(\frac{1}{2} + \frac{3}{4} : \frac{2}{3} \right) - \frac{3}{7} \cdot \left(\frac{4}{5} - \frac{3}{4} \right) = \frac{5}{3} \cdot \left(\frac{1}{2} + \frac{9}{8} \right) - \frac{3}{7} \cdot \left(\frac{16-15}{20} \right) = \frac{5}{3} \cdot \left(\frac{4+9}{8} \right) - \frac{3}{7} \cdot \left(\frac{16-15}{20} \right) = \frac{5}{3} \cdot \frac{13}{8} - \frac{3}{7} \cdot \frac{1}{20} = \frac{65}{24} - \frac{3}{140} = \frac{2275-18}{840} = \frac{2257}{840}$$

$$\text{n)} \quad \left(1 + \frac{1}{2} \right) \cdot \left(1 - \frac{1}{3} \right) + \left(\frac{1}{2} \right)^2 \cdot \left(\sqrt{\frac{16}{25}} - \frac{3}{5} \right) = \left(\frac{2+1}{2} \right) \cdot \left(\frac{3-1}{3} \right) + \frac{1}{4} \cdot \left(\frac{4}{5} - \frac{3}{5} \right) = \frac{3}{2} \cdot \frac{2}{3} + \frac{1}{4} \cdot \frac{1}{5} = 1 + \frac{1}{20} = \frac{20+1}{20} = \frac{21}{20}$$

4. Calcula y simplifica:

$$\text{a)} \quad -\sqrt{\frac{16}{9}} \cdot \left(\frac{1}{2} - 1 \right) + \frac{3}{4} \cdot \left(\frac{1}{3} + \frac{1}{2} : \frac{2}{3} \right) = -\frac{4}{3} \cdot \left(\frac{1-2}{2} \right) + \frac{3}{4} \cdot \left(\frac{1}{3} + \frac{3}{4} \right) = -\frac{4}{3} \cdot \left(\frac{-1}{2} \right) + \frac{3}{4} \cdot \left(\frac{4+9}{12} \right) = \frac{4}{6} + \frac{3}{4} \cdot \frac{13}{12} = \frac{4}{6} + \frac{39}{48} = \frac{2}{3} + \frac{13}{16} = \frac{32+39}{48} = \frac{71}{48}$$

$$\text{b)} \quad 3 - \frac{2}{3} \cdot \left(\frac{1}{4} - 1 \right)^2 + \frac{3}{8} \cdot (-2) = 3 - \frac{2}{3} \cdot \left(-\frac{3}{4} \right)^2 - \frac{6}{8} = 3 - \frac{2}{3} \cdot \frac{9}{16} - \frac{3}{4} = 3 - \frac{2 \cdot 3 \cdot 3}{3 \cdot 2 \cdot 8} - \frac{3}{4} = 3 - \frac{3}{8} - \frac{3}{4} = \frac{24-3-6}{8} = \frac{15}{8}$$

$$\text{c)} \quad \left(\frac{5}{2} - \frac{5}{6} + \frac{2}{3} \cdot \frac{1}{4} \right) : \left[2 - \sqrt{\frac{1}{4}} \cdot \left(1 + \frac{5}{3} \right) \right] = \left(\frac{5}{2} - \frac{5}{6} + \frac{2}{12} \right) : \left[2 - \frac{1}{2} \cdot \left(\frac{3+5}{3} \right) \right] = \left(\frac{5}{2} - \frac{5}{6} + \frac{1}{6} \right) : \left[2 - \frac{1}{2} \cdot \frac{8}{3} \right] = \left(\frac{15-5+1}{6} \right) : \left(2 - \frac{8}{6} \right) = \frac{11}{6} : \left(2 - \frac{4}{3} \right) = \frac{11}{6} : \frac{6-4}{3} = \frac{11}{6} : \frac{2}{3} = \frac{33}{12} = \frac{11}{4}$$

$$\text{d)} \quad \frac{2}{3} \cdot \left(\frac{3}{4} - \frac{1}{2} \right)^2 - \sqrt{\frac{1}{36}} \cdot \left(\frac{1}{3} - \frac{5}{6} \right)^2 = \frac{2}{3} \cdot \left(\frac{3-2}{4} \right)^2 - \frac{1}{6} \cdot \left(\frac{2-5}{6} \right)^2 = \frac{2}{3} \cdot \left(\frac{1}{4} \right)^2 - \frac{1}{6} \cdot \left(-\frac{1}{2} \right)^2 = \frac{2}{3} \cdot \frac{1}{16} - \frac{1}{6} \cdot \frac{1}{4} = \frac{2}{48} - \frac{1}{24} = \frac{1}{24} - \frac{1}{24} = 0$$

$$\text{e)} \quad 5 : \left(\frac{1}{2} + 1 \right)^{-2} + 3 : \left(\frac{1}{4} - \frac{1}{2} \right)^{-1} = 5 : \left(\frac{1+2}{2} \right)^{-2} + 3 : \left(\frac{1-2}{4} \right)^{-1} = 5 : \left(\frac{3}{2} \right)^{-2} + 3 : \left(-\frac{1}{4} \right)^{-1} = 5 : \left(\frac{2}{3} \right)^2 + 3 : (-4)^1 = 5 : \frac{4}{9} + 3 : (-4) = \frac{45}{4} - \frac{3}{4} = \frac{42}{4} = \frac{21}{2}$$

$$\text{f)} \quad -\frac{3}{8} \left[3 - \frac{3}{5} - \left(\frac{17}{20} - 1 \right) : \left(\frac{1}{3} - 3 \right)^{-1} \right] = -\frac{3}{8} \left[3 - \frac{3}{5} - \left(\frac{17-20}{20} \right) : \left(\frac{1-9}{3} \right)^{-1} \right] = -\frac{3}{8} \left[3 - \frac{3}{5} - \left(\frac{-3}{20} \right) : \left(\frac{-8}{3} \right)^{-1} \right] = -\frac{3}{8} \left[3 - \frac{3}{5} - \left(\frac{-3}{20} \right) : \left(\frac{-3}{8} \right) \right] = -\frac{3}{8} \left[3 - \frac{3}{5} - \frac{3 \cdot 8}{3 \cdot 20} \right] = -\frac{3}{8} \left[3 - \frac{3}{5} - \frac{2}{5} \right] = -\frac{3}{8} \left[\frac{15-3-2}{5} \right] = -\frac{3}{8} \cdot \frac{10}{5} = -\frac{3}{8} \cdot 2 = -\frac{6}{8} = -\frac{3}{4}$$

$$\begin{aligned} \text{g)} \quad & \left[\left(\frac{2}{3} - \frac{1}{9} \right) + 13 : \left(\frac{2}{3} - 1 \right)^{-2} \right] : \left(-\frac{3}{2} \right)^{-1} = \left[\left(\frac{6-1}{9} \right) + 13 : \left(-\frac{1}{3} \right)^{-2} \right] : \left(-\frac{2}{3} \right)^1 = \left[\left(\frac{5}{9} \right) + 13 : (-3)^2 \right] : \left(-\frac{2}{3} \right) = \\ & = \left[\frac{5}{9} + 13 : 9 \right] : \left(-\frac{2}{3} \right) = \left[\frac{5}{9} + \frac{13}{9} \right] : \left(-\frac{2}{3} \right) = \frac{18}{9} : \left(-\frac{2}{3} \right) = 2 : \left(-\frac{2}{3} \right) = -\frac{6}{2} = -3 \end{aligned}$$

$$\begin{aligned} \text{h)} \quad & \frac{\left(\frac{1}{4} - \frac{7}{8} \right) : \frac{2}{3} + 1}{\left(\frac{2}{3} - \frac{3}{4} \right) \cdot \frac{5}{6}} = \frac{\left(\frac{2-7}{8} \right) : \frac{2}{3} + 1}{\left(\frac{8-9}{12} \right) \cdot \frac{5}{6}} = \frac{\left(\frac{-5}{8} \right) : \frac{2}{3} + 1}{\left(\frac{-1}{12} \right) \cdot \frac{5}{6}} = \frac{-\frac{15}{16} + 1}{-\frac{5}{72}} = \frac{-\frac{15+16}{16}}{-\frac{5}{72}} = \frac{\frac{1}{16}}{-\frac{5}{72}} = \frac{1}{16} : \left(-\frac{5}{72} \right) = \\ & = \frac{1}{16} : \left(-\frac{5}{72} \right) = -\frac{72}{16 \cdot 5} = -\frac{8 \cdot 9}{8 \cdot 2 \cdot 5} = -\frac{9}{10} \end{aligned}$$

$$\begin{aligned} \text{i)} \quad & \frac{-1 + \frac{1}{4} \left(\frac{3}{5} - \frac{2}{15} \right)}{1 - \sqrt{\frac{4}{25}} : \left(\frac{1}{2} - \frac{3}{4} \right)^{-1}} = \frac{-1 + \frac{1}{4} \left(\frac{9-2}{15} \right)}{1 - \frac{2}{5} : \left(\frac{2-3}{4} \right)^{-1}} = \frac{-1 + \frac{1}{4} \left(\frac{7}{15} \right)}{1 - \frac{2}{5} : \left(\frac{-1}{4} \right)^{-1}} = \frac{-1 + \frac{7}{60}}{1 - \frac{2}{5} : (-4)} = \frac{-\frac{60+7}{60}}{1 + \frac{2}{20}} = \frac{-\frac{67}{60}}{1 + \frac{1}{10}} = \\ & = \frac{-\frac{67}{60}}{\frac{11}{10}} = -\frac{67}{60} : \frac{11}{10} = -\frac{67 \cdot 10}{60 \cdot 11} = -\frac{67}{66} \end{aligned}$$

$$\begin{aligned} \text{j)} \quad & \frac{\left(3 - \frac{1}{4} : \frac{3}{8} \right) : \sqrt{\frac{25}{16}} - (-2)^{-1}}{\left(\frac{3}{4} - \frac{1}{2} + \frac{1}{3} \right) : \left(\frac{19}{12} - \frac{1}{8} \right)} = \frac{\left(3 - \frac{8}{12} \right) : \frac{5}{4} - \left(-\frac{1}{2} \right)^1}{\left(\frac{9-6+4}{12} \right) : \left(\frac{38-3}{24} \right)} = \frac{\left(3 - \frac{2}{3} \right) : \frac{5}{4} + \frac{1}{2}}{\left(\frac{7}{12} \right) : \left(\frac{35}{24} \right)} = \frac{\frac{7}{3} : \frac{5}{4} + \frac{1}{2}}{\frac{7 \cdot 24}{12 \cdot 35}} = \\ & \frac{\frac{28}{15} + \frac{1}{2}}{\frac{7 \cdot 2 \cdot 12}{12 \cdot 5 \cdot 7}} = \frac{\frac{28}{15} + \frac{1}{2}}{\frac{7 \cdot 2 \cdot 12}{12 \cdot 5 \cdot 7}} = \frac{\frac{56+15}{30}}{\frac{2}{5}} = \frac{\frac{71}{30}}{\frac{2}{5}} = \frac{71}{30} : \frac{2}{5} = \frac{71 \cdot 5}{30 \cdot 2} = \frac{71 \cdot 5}{5 \cdot 6 \cdot 2} = \frac{71}{12} \end{aligned}$$

$$\begin{aligned} \text{k)} \quad & \frac{(-3)^{-2} : \left(\frac{3}{4} - \frac{1}{2} \right) - \frac{5}{12}}{5 \cdot \left(\frac{3}{4} - \frac{5}{6} \right) + \sqrt{\frac{1}{4}} : \frac{1}{3}} = \frac{\left(-\frac{1}{3} \right)^2 : \left(\frac{3-2}{4} \right) - \frac{5}{12}}{5 \cdot \left(\frac{9-10}{12} \right) + \frac{1}{2} : \frac{1}{3}} = \frac{\frac{1}{9} : \frac{1}{4} - \frac{5}{12}}{5 \cdot \left(\frac{-1}{12} \right) + \frac{3}{2}} = \frac{\frac{4}{9} - \frac{5}{12}}{-\frac{5}{12} + \frac{3}{2}} = \frac{\frac{16-15}{36}}{\frac{-5+18}{12}} = \frac{\frac{1}{36}}{\frac{13}{12}} = \frac{1}{36} : \frac{13}{12} = \\ & = \frac{12}{36 \cdot 13} = \frac{12}{12 \cdot 3 \cdot 13} = \frac{1}{39} \end{aligned}$$

$$\begin{aligned} \text{l)} \quad & \frac{\frac{4}{5} : \left(\frac{3}{4} - \frac{1}{2} \right)^{-1} - \left(2 + \frac{1}{3} \right) \cdot \frac{3}{4}}{\left(\frac{1}{6} - \frac{2}{3} \right) : \left(-\frac{1}{3} \right) + \left(\sqrt{\frac{1}{16}} - \frac{2}{5} \right) \cdot \frac{5}{12}} = \frac{\frac{4}{5} : \left(\frac{3-2}{4} \right)^{-1} - \left(\frac{6+1}{3} \right) \cdot \frac{3}{4}}{\left(\frac{1-4}{6} \right) : \left(-\frac{1}{3} \right) + \left(\frac{1}{4} - \frac{2}{5} \right) \cdot \frac{5}{12}} = \frac{\frac{4}{5} : \left(\frac{1}{4} \right)^{-1} - \left(\frac{7}{3} \right) \cdot \frac{3}{4}}{\left(\frac{-3}{6} \right) : \left(-\frac{1}{3} \right) + \left(\frac{5-8}{20} \right) \cdot \frac{5}{12}} = \\ & = \frac{\frac{4}{5} : 4 - \frac{7}{4}}{\frac{9}{6} + \left(\frac{-3}{20} \right) \cdot \frac{5}{12}} = \frac{\frac{4}{20} - \frac{7}{4}}{\frac{3}{2} - \frac{15}{240}} = \frac{\frac{1}{5} - \frac{7}{4}}{\frac{3}{2} - \frac{1}{16}} = \frac{\frac{4-35}{20}}{\frac{24-1}{16}} = \frac{-\frac{31}{20}}{\frac{23}{16}} = -\frac{31}{20} : \frac{23}{16} = -\frac{31 \cdot 16}{20 \cdot 23} = -\frac{31 \cdot 4 \cdot 4}{4 \cdot 5 \cdot 23} = -\frac{31 \cdot 4}{5 \cdot 23} = -\frac{124}{115} \end{aligned}$$