

- 1) $\frac{2+i}{-1+i} = \frac{(2+i)(-1-i)}{(-1+i)(-1-i)} = \frac{-2-2i-i-i^2}{1+i-i-i^2} = \frac{-2-3i+1}{1+1} = \frac{-1-3i}{2} = -\frac{1}{2} - \frac{3}{2}i$
- 2) $\overline{\left(\frac{3-2i}{-1+i}\right)} = \frac{\overline{3-2i}}{\overline{-1+i}} = \frac{3+2i}{-1-i} = \frac{(3+2i)(-1+i)}{(-1-i)(-1+i)} = \frac{-3+3i-2i+2i^2}{1-i+i-i^2} = \frac{-3+i-2}{1+1} = \frac{-5+i}{2} = -\frac{5}{2} + \frac{1}{2}i$
- 3) $(2-i)(-3+2i)(5-4i) = (-6+4i+3i-2i^2)(5-4i) = (-6+7i+2)(5-4i) = (-4+7i)(5-4i) = -20+16i+35i-28i^2 = -20+51i+28 = 8+51i$
- 4) $\left(\frac{5+5i}{3-4i}\right)^2 + \left(\frac{1}{i}\right)^2 = \frac{5+5i}{3-4i} \cdot \frac{5+5i}{3-4i} + \frac{1}{i} \cdot \frac{1}{i} = \frac{25+25i+25i+25i^2}{9-12i-12i+16i^2} + \frac{1}{i^2} = \frac{25+50i-25}{9-24i-16} + \frac{1}{-1} = \frac{50i}{-7-24i} - 1 = \frac{50i(-7+24i)}{(-7-24i)(-7+24i)} - 1 = \frac{-350i+1200i^2}{49-168i+168i-576i^2} - 1 = \frac{-350i-1200}{49+576} - 1 = \frac{-1200-350i}{625} - 1 = -\frac{1200}{625} - \frac{350}{625}i - 1 = -\frac{48}{25} - 1 - \frac{14}{25}i = -\frac{73}{25} - \frac{14}{25}i$
- 5) $\frac{1+i}{3-i} + \overline{\left(\frac{1+i}{3-i}\right)} = \frac{1+i}{3-i} + \left(\frac{\overline{1+i}}{\overline{3-i}}\right) = \frac{1+i}{3-i} + \frac{1-i}{3+i} = \frac{(1+i)(3+i)}{(3-i)(3+i)} + \frac{(1-i)(3-i)}{(3+i)(3-i)} = \frac{3+i+3i+i^2}{9-3i+3i-i^2} + \frac{3-i-3i+i^2}{9-3i+3i-i^2} = \frac{3+4i-1}{9+1} + \frac{3-4i-1}{9+1} = \frac{2+4i}{10} + \frac{2-4i}{10} = \frac{2}{10} + \frac{4}{10}i + \frac{2}{10} - \frac{4}{10}i = \frac{4}{10} = \frac{2}{5}$
- 6) $\frac{5+5i}{3-4i} + \frac{20}{4+3i} = \frac{(5+5i)(3+4i)}{(3-4i)(3+4i)} + \frac{20(4-3i)}{(4+3i)(4-3i)} = \frac{15+20i+15i+20i^2}{9+12i-12i-16i^2} + \frac{80-60i}{16-12i+12i-9i^2} = \frac{15+35i-20}{9+16} + \frac{80-60i}{16+9} = \frac{-5+35i}{25} + \frac{80-60i}{25} = -\frac{5}{25} + \frac{35}{25}i + \frac{80}{25} - \frac{60}{25}i = \frac{75}{25} - \frac{25}{25}i = 3-i$
- 7) $\frac{i(2-i)^3}{-3+i} = \frac{i(2-i)(2-i)(2-i)(-3-i)}{(-3+i)(-3-i)} = \frac{i(4-2i-2i+i^2)(-6-2i+3i+i^2)}{9+3i-3i-i^2} = \frac{i(4-4i-1)(-6+i-1)}{9+1} = \frac{i(3-4i)(-7+i)}{10} = \frac{i(-21+3i+28i-4i^2)}{10} = \frac{i(-21+31i+4)}{10} =$

$$\frac{i(-17 + 31i)}{10} = \frac{-17i + 31i^2}{10} = \frac{-31 - 17i}{10} = -\frac{31}{10} - \frac{17}{10}i$$

$$8) \frac{(5 + 5i) - \overline{(5 + 5i)}}{(1 + 2i)\overline{(1 + 2i)}} = \frac{(5 + 5i) - (5 - 5i)}{(1 + 2i)(1 - 2i)} = \frac{5 + 5i - 5 + 5i}{1 - 2i + 2i - 4i^2} = \frac{10i}{1 + 4} = \frac{10i}{5} = 2i$$

$$9) \frac{\frac{1+i}{i} + \frac{i}{1-i}}{\frac{i-1}{i+1}} = \frac{\frac{(1+i)(-i)}{i(-i)} + \frac{i(1+i)}{(1-i)(1+i)}}{\frac{(i-1)(i-1)}{(i+1)(i-1)}} = \frac{\frac{-i-i^2}{-i^2} + \frac{i+i^2}{1-i+i-i^2}}{\frac{i^2-i-i+1}{i^2-i+i-1}} =$$

$$\frac{\frac{-i+1}{1} + \frac{i-1}{1+1}}{\frac{-1-2i+1}{-1-1}} = \frac{1-i-\frac{1}{2}+\frac{1}{2}i}{\frac{-2i}{-2}} = \frac{\frac{1}{2}-\frac{1}{2}i}{i} = \frac{\left(\frac{1}{2}-\frac{1}{2}i\right)(-i)}{i(-i)} =$$

$$\frac{-\frac{1}{2}i + \frac{1}{2}i^2}{-i^2} = \frac{-\frac{1}{2}i - \frac{1}{2}}{1} = -\frac{1}{2} - \frac{1}{2}i$$