Simplify the following Rational Expressions – Multiplication and Division

1. $\frac{-8x^2}{y^3} \cdot \frac{15y}{4x} = \frac{-2 \cdot 2 \cdot 2 \cdot x^2 \cdot 3 \cdot 5 \cdot y}{y^3 \cdot 2 \cdot 2 \cdot x} = \frac{-2 \cdot 3 \cdot 5 \cdot x}{y^2}$

2. $\frac{2rs}{3} \cdot \frac{-3}{4s} = \frac{-r}{2}$

3. $\frac{24m^6n}{18m^3} \cdot \left(\frac{2m}{9n^4}\right) = \frac{2 \cdot 2 \cdot 2 \cdot 3 \cdot m^6 \cdot n \cdot 2 \cdot m}{2 \cdot 3 \cdot 3 \cdot m^3 \cdot 3 \cdot 3 \cdot n^4} = \frac{2 \cdot 2 \cdot 2 \cdot m^4}{3 \cdot 3 \cdot 3 \cdot n^3}$

4. $\frac{(2a^2)}{(3b)} \cdot \frac{(15b^3)}{(2a)} = \frac{2 \cdot a^2 \cdot 3 \cdot 5 \cdot b^3}{3 \cdot b \cdot 2 \cdot a} = \frac{5a}{b^2}$

5. $\frac{(9xy^3)}{(3ay)} \cdot \frac{(8a^4x)}{(2y)} = \frac{3 \cdot 3 \cdot x \cdot y^3 \cdot 2 \cdot 2 \cdot 2 \cdot a^4 \cdot x}{3 \cdot a \cdot y \cdot 2 \cdot y} = 3 \cdot 2 \cdot 2 \cdot a^3 \cdot x^2 \cdot y$

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

7. $\frac{x^2 - 9}{4x + 12} \cdot \frac{6}{x-3} = \frac{(x+3)(x-3) \cdot 2 \cdot 3}{2 \cdot 2(x+3) \cdot (x-3)} = \frac{3}{2}$

8. $\frac{y^2 + 6y - 16}{y^2 - 64} \cdot \frac{1}{(y-2)} = \frac{(x+8)(x-2)}{(x+8)(x-8) \cdot (y-2)} = \frac{1}{(x-8)}$

9. $\frac{2y^2 - 50}{2y - 10} \cdot \frac{(4y-2)}{(6y+30)} = \frac{2(y+5)(y-5) \cdot 2(2y-1)}{2(y-5) \cdot 2 \cdot 3(y+5)} = \frac{(2y-1)}{3}$

10. $\frac{2z - 14}{z^2 - 2z - 35} \div \frac{6z^3}{z^2 - 25} = \frac{2z - 14}{z^2 - 2z - 35} \cdot \frac{z^2 - 25}{6z^3} = \frac{2(z-7) \cdot (z+5)(z-5)}{(z-7)(z+5) \cdot 2 \cdot 3 \cdot z^3} = \frac{(z-5)}{3z^3}$

11. $\frac{a^2 - 4a}{a^2 + 2a} \div \left(\frac{a^2 - 9a + 20}{a^2 - 3a - 10}\right) = \frac{a^2 - 4a}{a^2 + 2a} \cdot \frac{a^2 - 3a - 10}{a^2 - 9a + 20} = \frac{a(a-4) \cdot (a-5)(a+2)}{a(a+2) \cdot (a-5)(a-4)} = 1$

12. $$\frac{2z-8}{z^2-4}\div\frac{z-4}{z^2+6z+8}=\frac{2z-8}{z^2-4}\cdot\frac{z^2+6z+8}{z-4}=\frac{2(z-4)\cdot(z+4)(z+2)}{(z+2)(z-2)\cdot(z-4)}=\frac{2(z+4)}{(z-2)}$$

13. $$\frac{1+3b-18b^2}{6b^2-17b-3}\div\left(\frac{3b-1}{b-3}\right)=\frac{1+3b-18b^2}{6b^2-17b-3}\cdot\frac{b-3}{3b-1}=\frac{-1(6b+1)(3b-1)\cdot(b-3)}{(6b+1)(b-3)\cdot(3b-1)}=-1$$

14. $$\frac{3a+6c}{9a}\cdot\frac{12ac}{a^2-4c^2}\div\frac{18a^3c^3}{2a-4c}=\frac{3a+6c}{9a}\cdot\frac{12ac}{a^2-4c^2}\cdot\frac{2a-4c}{18a^3c^3}=$$
$$\frac{3(a+2c)\cdot2\cdot2\cdot3\cdot a\cdot c\cdot2(a-2c)}{3\cdot3\cdot a\cdot(a+2c)(a+2c)\cdot2\cdot3\cdot3\cdot a^3\cdot c^3}=\frac{2\cdot2}{3\cdot3\cdot a^3\cdot c^2}$$

15. $$\frac{5c^2-5c}{4a^3}\cdot\frac{c^2-9c-10}{4c-40}\div\frac{2-2c^2}{a}=\frac{5c^2-5c}{4a^3}\cdot\frac{c^2-9c-10}{4c-40}\cdot\frac{a}{2-2c^2}=$$
$$\frac{5c(c-1)\cdot(c-10)(c+1)\cdot a}{2\cdot2\cdot a^3\cdot2\cdot2\cdot(c-10)\cdot-2(c+1)(c-1)}=\frac{5c}{-1\cdot2^5a^2}$$

16. $$\frac{12a^2-3}{15}\cdot\frac{1}{(2a+1)}\cdot\frac{5}{2a+1}=\frac{3(2a+1)(2a-1)\cdot5}{3\cdot5\cdot(2a+1)\cdot(2a+1)}=\frac{(2a-1)}{(2a+1)}$$

17. $$\frac{15-13x+2x^2}{4x^2-9}\cdot\frac{2x+1}{1-2x}\div\left(\frac{5-x}{2x-1}\right)=\frac{15-13x+2x^2}{4x^2-9}\cdot\frac{2x+1}{1-2x}\cdot\frac{2x-1}{5-x}=$$
$$\frac{(2x-3)(x-5)\cdot(2x+1)\cdot-1(x-5)}{(2x+3)(2x-3)\cdot-1(2x-1)\cdot-1(x-5)}=\frac{(x-5)(2x+1)}{-1\cdot(2x+3)(2x-1)}$$

18. $$\frac{30-11p+p^2}{9p-6p^2+p^3}\cdot\frac{p^2-3p}{25-p^2}\div\left(\frac{p^2-9}{p^2+2p-15}\right)=\frac{30-11p+p^2}{9p-6p^2+p^3}\cdot\frac{p^2-3p}{25-p^2}\cdot\frac{p^2+2p-15}{p^2-9}=$$
$$\frac{(p-5)(p-6)\cdot p(p-3)\cdot(p+5)(p-3)}{p(p-3)(p-3)\cdot-1(p-5)(p+5)\cdot(p+3)p-3)}=\frac{(p-6)}{-1\cdot(p+3)(p-3)}$$