1. $5xy^2 - \left(\frac{1}{3}xy^2 + 5xy^2\right) - \frac{1}{6}xy^2$

$= 5xy^2 - \frac{1}{3}xy^2 - 5xy^2 - \frac{1}{6}xy^2 = \frac{-2-1}{6}xy^2 = \boxed{-\frac{1}{2}xy^2}$

2. $\frac{5}{4}a^3b\left(-\frac{4}{3}a^3b^2\right) + \frac{13}{6}a^8b^9 : \left(2a^2b^6 - \frac{11}{12}a^2b^6\right)$

$= -\frac{5}{3}a^6b^3 + \frac{13}{6}a^8b^9 : \left(\frac{13}{12}a^2b^6\right) = -\frac{5}{3}a^6b^3 + 2\,a^6b^3 = \frac{-5+6}{3}a^6b^3 = \boxed{\frac{1}{3}a^6b^3}$

3. $\frac{x^3y}{3} - \frac{1}{6}x(-x^2y) - \left[\left(-5x + \frac{1}{3}x\right)\cdot(-2x^2y + x^2y)\right]$

$= \frac{x^3y}{3} + \frac{1}{6}x^3y - \left[\left(-\frac{14}{3}x\right)\cdot(-x^2y)\right] = \frac{x^3y}{3} + \frac{1}{6}x^3y - \frac{14}{3}x^3y = \frac{2+1-28}{6}x^3y = \boxed{-\frac{25}{6}x^3y}$

4. $[(ab^2)^3\,a^2]^4 : \left(-3a^3b\cdot\frac{1}{2}a^4b^3\right)^2 : (ab^4)^4$

$= [a^3b^6\,a^2]^4 : \left(-\frac{3}{2}a^7b^4\right)^2 : (a^4b^{16}) = [a^5b^6]^4 : \left(+\frac{9}{4}a^{14}b^8\right) : (a^4b^{16}) =$

$= a^{20}b^{24} : \left(+\frac{9}{4}a^{14}b^8\right) : (a^4b^{16}) = \frac{4}{9}a^6b^{16} : (a^4b^{16}) = \boxed{\frac{4}{9}a^2}$

5. $2xy^2\cdot 3y(-2xy) + 2y^2\left[-\frac{1}{4}xy + \frac{1}{2}x\left(-\frac{3}{2}y\right)\right]^2$

$= -12x^2y^4 + 2y^2\left[-\frac{1}{4}xy - \frac{3}{4}xy\right]^2 = -12x^2y^4 + 2y^2[-xy]^2 =$

$= -12x^2y^4 + 2y^2[x^2y^2] = -12x^2y^4 + 2x^2y^4 = \boxed{-10x^2y^4}$

6. $(x-y) - [(3x+2y) - (4x-5y)] + (-7) + 8y$

$= x - y - [3x + 2y - 4x + 5y] - 7 + 8y = x - y - 3x - 2y + 4x - 5y - 7 + 8y = \boxed{2x - 7}$

7. $2a(a^2 - 3b) - 3b(b - 2a)$

$= 2a^3 - 6ab - 3b^2 + 6ab = \boxed{2a^3 - 3b^2}$