Exercises 1

1. Simplify each of the following (*Hint*: use the rules of exponents where needed).
   a. $x = 3pq + 5pr = 2qr + qp - 6rp$
   b. $y = 5l^2mn + 2nl^2m - 3mln^2 + l^2nm + 4n^2ml - nm^2$
   c. $z = \frac{(s^{\frac{1}{3}})^{\frac{3}{4}} \times (t^{\frac{1}{4}})^{-1}}{(t^{\frac{1}{2}} \times (s^{-\frac{1}{4}})^{-1})}$
2. Remove the brackets in each of the following and simplify the expression.
   a. $-4x(2x - y)(3x + 2y)$
   b. $(a - 2b)(2a - 3b)(3a - 4b)$
   c. $-\{-2[x - 3(y - 4)] - 5(z + 6)\}$
   d. $(v^3 - v^2 - 2)(1 - 3v + 2v^2)$
3. Simplify each of the following.
   a. $\frac{p}{q^3} \div \frac{p^3}{q}$
   b. $\frac{a^2b}{2c} \times \frac{ac^2}{2b} \div \frac{b^2c}{2a}$
   c. $\frac{8x^{-3} \times 3x^2}{6x^{-4}}$
   d. $\frac{3x}{3x^2+6x}$
4. Factorise the following expressions.
   a. $18x^2y - 12xy^2$
   b. $x^3 + 4x^2y - 3xy^2 - 12y^3$
   c. $25x^2 - 4y^2$
   d. $3x^2 - 14x + 8$
   e. $x^2 + 10x + 25$
5. The characteristic equation of a perfect gas is given by $PV = mRT$ where m is the mass, P is the pressure, V is the volume, T is the temperature and R is the universal gas constant. Make temperature the subject of the formula.
6. The airflow over a turbine blade causes drag D, which is given by $D = \frac{\rho C v^2 A}{2}$, where ρ is fluid density, C is the drag coefficient, v is fluid velocity and A is the frontal area of the blade. Make the frontal area the subject of the formula.
7. Make b the subject of the following formula.
$$W = \frac{t\sqrt{a + b^2}}{2\pi}$$
8. Solve the following quadratic equations by factorisation.
   a. $x^2 - 28x - 60 = 0$
   b. $p^2 = 8p - 15$
   c. $-2y^2(3 + y^2) = (2y^2 + 2y - 3)(-y^2 + y - 4) - 2$
9. Solve the following quadratic equations, giving results correct to 2 d.p.
   a. $4x^2 + x - 3 = 0$
   b. $x^2 + x = 5$
   c. $x + \frac{1}{x} = 5$

10. Solve the following sets of simultaneous equations.

    a. $3x + 4y = 7$, $5x + 6y = 11$
    b. $2x + y = 7$, $x^2 - xy = 6$
    c. $x + y = 2$, $w^2 - xy + y^2 = 1$

11. Solve the following inequalities.

    a. $7 - 3x > x - 5$
    b. $x^2 \geq 4$
    c. $x^2 - x - 6 < 0$
    d. $x^2 - 3x - 12 \leq 2x + 2$
    e. $\frac{2}{2x-1} > \frac{3}{3x+1}$
    f. $\frac{2x}{x-5} \leq 3$
    g. $x^3 - 9x^2 < 0$