1 Solve the equation $\frac{2x}{x+1} - \frac{1}{x-1} = 1$. **[4]**

2 Express $\frac{x+1}{x(2x-1)}$ in partial fractions. **[5]**

3 Express $\frac{3x+2}{x(x^2+1)}$ in partial fractions. **[6]**

4 Express $\frac{4}{x(x^2+4)}$ in partial fractions. [6]

5 Solve the equation $\frac{2x}{x-2} - \frac{4x}{x+1} = 3$. [5]

6 **(i)** Express $\frac{x}{(1+x)(1-2x)}$ in partial fractions. **[3]**

(ii) Hence use binomial expansions to show that $\frac{x}{(1+x)(1-2x)} = ax + bx^2 + \ldots$, where a and b are constants to be determined.

State the set of values of x for which the expansion is valid. **[5]**

7 A skydiver drops from a helicopter. Before she opens her parachute, her speed v m s^{-1} after time t seconds is modelled by the differential equation

$$\frac{dv}{dt} = 10e^{-\frac{1}{2}t}.$$

When $t = 0$, $v = 0$.

(i) Find v in terms of t. [4]

(ii) According to this model, what is the speed of the skydiver in the long term? [2]

She opens her parachute when her speed is 10 m s^{-1}. Her speed t seconds after this is w m s^{-1}, and is modelled by the differential equation

$$\frac{dw}{dt} = -\tfrac{1}{2}(w-4)(w+5).$$

(iii) Express $\dfrac{1}{(w-4)(w+5)}$ in partial fractions. [4]

(iv) Using this result, show that $\dfrac{w-4}{w+5} = 0.4e^{-4.5t}$. [6]

(v) According to this model, what is the speed of the skydiver in the long term? [2]