This week on the problem set you will get practice at polynomial long division, using the partial fractions method and applying these to integrals.

*Numbers in parentheses indicate the question has been taken from the textbook:

S. J. Schreiber, *Calculus for the Life Sciences*, Wiley,

and refer to the section and question number in the textbook.

1. Divide $p(x)$ by $q(x)$ and express the quotient as a divisor plus a remainder.
   (a) $p(x) = 2x^3 + 4x^2 - 5$, $q(x) = x + 3$
   (b) $p(x) = 15x^4 - 3x^2 - 6x$, $q(x) = 3x + 6$
   (c) $p(x) = 2x^4 - 5x^3 + 6x^2 + 3x - 2$, $q(x) = x - 2$
   (d) $p(x) = 5x^4 + 2x^3 + x^2 - 3x + 1$, $q(x) = x + 2$
   (e) $p(x) = x^6$, $q(x) = x - 1$
   (f) $p(x) = x^3 - 5x^2 + x - 15$, $q(x) = x^2 - 1$
   (g) $p(x) = x^3 - 2x^2 - 5x + 7$, $q(x) = x^2 + x - 6$
   (h) $p(x) = x^3 + 3x^2 - 6x - 7$, $q(x) = x^2 + 2x - 8$
   (i) $p(x) = 2x^3 - 8x^2 + 8x - 4$, $q(x) = 2x^2 - 4x + 2$
   (j) $p(x) = 3x^4 - x^3 - 2x^2 + 5x - 1$, $q(x) = x + 1$
   (k) $p(x) = 4x^5 + 7x^4 - 9x^3 + 2x^2 - x + 3$, $q(x) = x^2 - 4x + 3$
   (l) $p(x) = 4x^5 + 7x^4 - 9x^3 + 2x^2 - x + 3$, $q(x) = x^3 + x^2 - 5x + 3$
   (m) Make up your own! Pick random polynomials and divide!

2. Use the method of partial fractions to break up these rational functions.
   (a) $\frac{2}{(x-2)x}$
   (b) $\frac{5}{(x-2)(x+3)}$
   (c) $\frac{7}{(x+6)(x-1)}$
   (d) $\frac{5x}{(x-1)(x+4)}$
   (e) $\frac{x}{(x+1)(x+2)}$
   (f) $\frac{12x-6}{(x-3)(x+3)}$
   (g) $\frac{x-1}{(x+2)(x+1)}$
   (h) $\frac{1}{x^2-x-6}$
   (i) $\frac{11}{x^2-3x-28}$
   (j) $\frac{10}{x^2+2x-24}$
   (k) $\frac{4x}{x^2+6x+5}$
   (l) $\frac{3x}{x^2-7x+10}$
   (m) $\frac{1}{x^3-2x^2-5x+6}$
   (n) $\frac{4x^2-x}{x^3-4x^2-x+4}$

3. Use the method of partial fractions to break up these rational functions.
   (a) $\frac{x}{(x+1)^2}$
   (b) $\frac{2x-1}{(x+3)^2}$

(c) $\frac{1-3x}{(x-1)^2}$

(d) $\frac{1+3x}{(x-2)^2}$

(e) $\frac{2x^2}{(x-1)^3}$

(f) $\frac{x-1}{(x-2)^3}$

(g) $\frac{x-3}{(x+2)^2(x-2)}$

(h) $\frac{x}{(x-1)(x+3)^2}$

4. Integrate the functions in question 2 and question 3.

5. Calculate $\int \frac{p(x)}{q(x)}\,\mathrm{d}x$ for each part of question 1.