MAS051 — Test 3 — Sample

1. Solve the following equation for x:
$$\frac{2}{x+2} - \frac{1}{x+3} + \frac{3}{x+1} = 0.$$

2. Factorise the quadratic $2x^2 + 2x - 35$.

3. Complete the square of $x^2 - 15x + 9$ and simplify your answer to the form $(x-b)^2 + c$, for some fractions b and c.

4. Factorise the cubic $x^3 + 6x^2 - 25x + 18$ given that it has a root $x = -9$.

5. Determine the domains of the following functions.

   (a) $\dfrac{1}{x}$ (b) $\dfrac{1}{x(x+1)}$ (c) $\sqrt{1+2x}$

6. Determine the ranges of the following functions.

   (a) $1 - x^5$ (b) $\sqrt{1-\sin(x)}$ (c) $\dfrac{1}{4+x^2}$

7. Use your calculator to evaluate to 4 decimal places
$$\frac{1-\cos(x)}{x^2}$$
   (a) when $x = 0.1$ and (b) when $x = 0.01$.

   Guess the value of
$$\lim_{x\to 0} \frac{1-\cos(x)}{x^2}.$$

8. Differentiate

   (a) $2x^3 + 3x^2 - x - 2$ (b) $5x^6 - 4x^3 + 2x^2 - 5x + 3$

9. Let
$$f(x) = 2\sin(3x) \quad \text{and} \quad g(x) = (x^3 - 3x + 2).$$
   Find $f(g(x))$ and $g(f(x))$.

10. Let
$$f(x) = \sqrt{3x+4}, \quad \text{where} \quad x > -4/3.$$
    Which of the following functions is the inverse f^{-1} of f?

    (a) $\dfrac{1}{\sqrt{3x+4}}$ (b) $\sqrt{4-3x}$ (c) $\dfrac{x^2-4}{3}$