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**1.** Given that

$$\frac{2x^4 - 3x^2 + x + 1}{(x^2 - 1)} \equiv (ax^2 + bx + c) + \frac{dx + e}{(x^2 - 1)},$$

find the values of the constants $a$, $b$, $c$, $d$ and $e$.

**(4)**

The new syllabus requires division by linear factors only. However, dividing by a quadratic factor is no more difficult.

Leave blank

**4.** The function f is defined by

$$\mathrm{f} : x \mapsto \frac{2(x-1)}{x^2-2x-3} - \frac{1}{x-3}, \qquad x > 3.$$

(a) Show that $\mathrm{f}(x) = \dfrac{1}{x+1}, \quad x > 3.$ **(4)**

(b) Find the range of f. **(2)**



(c) Find $\mathrm{f}^{-1}(x)$. State the domain of this inverse function. **(3)**

The function g is defined by

$$\mathrm{g} : x \mapsto 2x^2 - 3, \quad x \in \mathbb{R}.$$

(d) Solve $\mathrm{fg}(x) = \dfrac{1}{8}$. **(3)**

Leave blank

**2.**
$$\mathrm{f}(x) = \frac{2x+2}{x^2-2x-3} - \frac{x+1}{x-3}$$

(a) Express $\mathrm{f}(x)$ as a single fraction in its simplest form.

**(4)**

(b) Hence show that $\mathrm{f}'(x) = \dfrac{2}{(x-3)^2}$

**(3)**

Leave blank

**7.** The function f is defined by

$$f(x) = 1 - \frac{2}{(x+4)} + \frac{x-8}{(x-2)(x+4)}, \quad x \in \mathbb{R},\ x \neq -4,\ x \neq 2$$

(a) Show that $f(x) = \dfrac{x-3}{x-2}$ **(5)**

The function g is defined by

$$g(x) = \frac{e^x - 3}{e^x - 2}, \quad x \in \mathbb{R},\ x \neq \ln 2$$

(b) Differentiate $g(x)$ to show that $g'(x) = \dfrac{e^x}{(e^x - 2)^2}$ **(3)**

(c) Find the exact values of $x$ for which $g'(x) = 1$ **(4)**

Leave blank

**1.** Express

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

as a single fraction in its simplest form.

**(4)**

Leave blank

**8.** (a) Simplify fully

$$\frac{2x^2 + 9x - 5}{x^2 + 2x - 15}$$

**(3)**

Given that

$$\ln(2x^2 + 9x - 5) = 1 + \ln(x^2 + 2x - 15), \quad x \neq -5,$$

(b) find $x$ in terms of e.

**(4)**