1. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

$$f(x) = ax^3 + 7x^2 - 46x + 24$$

where a is a constant.

(a) Find, in simplest form in terms of a, the remainder when $f(x)$ is divided by $(x - 2)$

(2)

Given that $(x - 2)$ is a factor of $f(x)$,

(b) show that $a = 5$

(1)

(c) factorise $f(x)$ completely.

(4)

(Total for Question 1 is 7 marks)

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2. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

Given that k is a constant,

(a) use algebraic integration to find

$$\int_1^4 kx^{-3} + 4x^{\frac{3}{2}} \, dx$$

giving the answer in simplest form in terms of k.

(4)

(b) Hence find the exact value of k for which

$$\int_1^4 kx^{-3} + 4x^{\frac{3}{2}} \, dx = 50$$

(2)

(Total for Question 2 is 6 marks)

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3. The sequence $u_1, u_2, u_3, \ldots$ satisfies

$$u_1 = 5 \qquad u_{n+1} = \frac{3}{2}u_n - \frac{1}{2}u_n^2 + 4$$

(a) Show that this sequence is periodic, stating its period.

(3)

(b) State the value of u_{200}

(1)

(c) Find, showing all steps of your working, the value of

$$\sum_{r=1}^{200} u_r$$

(3)

(Total for Question 3 is 7 marks)

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4. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

The curve C has equation

$$y = 2x^3 + 7x + \frac{3}{x}$$

(a) Find the exact values of the x coordinates of the stationary points of C.

(4)

(b) Hence find the exact range of values of x for which C is increasing.

(2)

(Total for Question 4 is 6 marks)