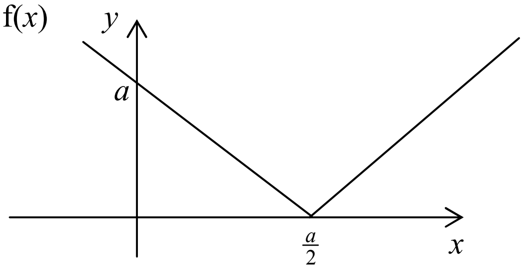
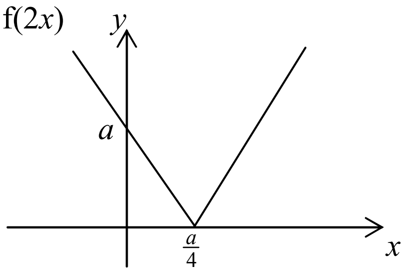
**EDEXCEL CORE MATHEMATICS C3 PRACTICE PAPER A1 MARK SCHEME**

| Question Number | Scheme | Marks |
|---|---|---|
| **1.** | $\dfrac{(x-3)(x-5)}{(x-3)(x+3)} \times \dfrac{2x(x+3)}{(x-5)^2}$ (3 × factorising)<br>$= \dfrac{2x}{x-5}$ | B1 B1 B1<br>B1<br>**(4 marks)** |
| **2.** (*a*) | $f(x) = x + \ln 2x - 4$; $x_{n+1} = 4 - \ln 2x_n$, $x_0 = 2.4$<br>$x_1 = 2.431\ldots$ A single sound application of<br>$x_2 = 2.418\ldots$ iteration<br>$x_3 = 2.423\ldots$ At least $x_3$ reached<br>Root = 2.422 (A2)<br>2.42 or "correct" unrounded to 3 d.p. answer A1 | <br><br>M1<br>M1<br><br>A2, 1, 0 (4) |
| (*b*) | Choosing an appropriate interval e.g. [2.4215, 2.4225]<br>Establishing change of sign + Conclusion | M1<br>A1 (2)<br>**(6 marks)** |
| **3.** (*a*) | $y = f(x)$   Fairly even ∨, vertex on +ve $x$ axis<br>Only $(\frac{a}{2}, 0)$ and $(0, a)$ on graph on in text | B1<br>B1 (2) |
| (*b*) | $y = f(2x)$   Steeper, even ∨ and 1 correct intersection<br>Only both $(\frac{a}{4}, 0)$ and $(0, a)$ on graph or in text | B1<br>[ft $\frac{a}{2}$ from (*a*)]<br>B1 (2) |
| (*c*) | $-(2x - a) = \dfrac{1}{2}x$ when $x = 4$, $\Rightarrow a - 8 = 2$ $\therefore a = 10$<br>$2x - a = \dfrac{1}{2}x$ when $x = 4$, $\Rightarrow 8 - a = 2$ $\therefore a = 6$ | M1, A1<br>M1, A1 (4)<br>**(8 marks)** |

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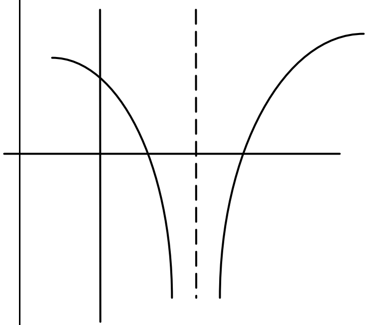
|---|---|---|
| **4.** | $\dfrac{1-\tan^2\theta}{1+\tan^2\theta} = \dfrac{1-\dfrac{\sin^2\theta}{\cos^2\theta}}{1+\dfrac{\sin^2\theta}{\cos^2\theta}}$ $\left(\text{or } \dfrac{1-\dfrac{\sin^2\theta}{\cos^2\theta}}{\sec^2\theta} \text{ or equivalent}\right)$ | M1 M1 |
| | $\dfrac{\cos^2\theta-\sin^2\theta}{\cos^2\theta+\sin^2\theta} = \dfrac{\cos 2\theta}{1} = \cos 2\theta$ * | M1 A1 (4) |
| | | **(4 marks)** |
| **5.** | $\dfrac{3}{x(x+2)} + \dfrac{x-4}{(x+2)(x-2)}$ | B1 B1 |
| | $= \dfrac{3(x-2)+x(x-4)}{x(x+2)(x-2)}$ | M1 A1 |
| | $= \dfrac{(x-3)(x+2)}{x(x+2)(x-2)}$ | M1 A1 A1 |
| | | **(7 marks)** |
| **6.** (*a*) | $f''(x) = 2x - 2x{-}3$ | M1 A1 |
| | $= 8 - \dfrac{6}{24} = 7\dfrac{31}{32}$ (7.97) | A1 (3) |
| (*b*) | $f(x) = \dfrac{1}{3}x^3 - 2x - \dfrac{1}{x}$ (+C) | M1 A1 |
| | $0 = 9 - 6 - \dfrac{1}{3} + C$ $C = -\dfrac{8}{3}$ (or –2.67) | M1 A1 (4) |
| (*c*) | $f'(x) > 0$ needed, or $f'(x) \geq 0$, or "as $x$ increases, $f(x)$ increases" | B1 |
| | $f'(x) = (x - \dfrac{1}{x})^2$, $> 0$ always, or $\geq 0$ always | M1, A1 (3) |
| | | **(10 marks)** |

| Question Number | | Scheme | Marks |
|---|---|---|---|
| **7.** (*a*) | | $f(x) = \frac{2(2x+1)-6}{(x-1)(2x+1)}, = \frac{4x-4}{(x-1)(2x-1)}$ (M for attempt same denominator) | M1, A1 |
| | i.e | $f(x) = \frac{4(x-1)}{(x-1)(2x-1)}, = \frac{4}{(2x+1)}$ * (M for factorising) | M1, A1 c.s.o (4) |
| (*b*) | | $0 < f < \frac{4}{3}$ or $0 < y < \frac{4}{3}$ $\alpha < f < \beta$, $\alpha = 0$ or $\beta = \frac{4}{3}$ | B1 |
| | | Both | B1 (2) |
| (*c*) | | $y = \frac{4}{2x=1}$ $\Rightarrow y\,(2x+1) = 4$ | M1 |
| | | i.e $x = \frac{4-y}{2y}$ | M1 |
| | | $\therefore f^{-1}(x) = \frac{4-x}{2x}$ (o.e) must be $f^{-1}(x)$ | A1 (3) |
| (*d*) | Range of $f^{-1}$ = domain of f $\therefore$ $f^{-1} > 1$ or $y > 1$ or $> 1$ | | B1 (1) |
| | | | **(10 marks)** |

| Question Number | Scheme |
|---|---|
| **8.** (*a*) | $y = \ln(3x - 6) \Rightarrow 3x - 6 = e^{y}$ |
| | $\Rightarrow x = \frac{e^{y} + 6}{3}$; $\{f^{-1}(x)\} = \frac{e^{x} + 6}{3}$ |
| (*b*) | Domain: $x \in \Re$ |
| | Range: $f^{-1}(x) > 2$ |
| (*c*) | Attempting to find $f^{-1}(3)$ $[= \frac{e^{3} + 6}{3}]$; $= 8.70$ |
| (*d*) |  ln curve passing through $y = 0$; Symmetry in $x = k$, $k > 0$; All correct and asymptote at $x = 2$ labelled |
| (*e*) | Meets $y$-axis: $(x = 0)$, $y = \ln 6$ |
| | Meets $x$-axis: $x = \frac{5}{3}$, $(0)$; $x = \frac{7}{3}$, $(0)$ |
| | [May be seen on g |