INTEGRATION INVOLVING LOGARITHMIC FUNCTIONS

1 Find $f(x)$ and the domain of f for the following.

(a) $f'(x)=\frac{1}{x+1}$ **(b)** $f'(x)=\frac{2}{2x+1}$ **(c)** $f'(x)=\frac{x^2}{8-x^3}$ **(d)** $f'(x)=\frac{1}{2-4x}$

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(i) $f'(x)=\dfrac{x}{(1+x^2)^2}$ (j) $f'(x)=\dfrac{x}{\sqrt{1+x^2}}$ (k) $f'(x)=\dfrac{1}{2x+5}$ (l) $f'(x)=\dfrac{1}{(2x+5)^2}$

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(q) $f'(x)=\dfrac{x^2-5x+1}{x-2}$ **(r)** $f'(x)=\dfrac{x^3}{x+1}$ **(s)** $f'(x)=\dfrac{x+3}{x^2+6x-7}$ **(t)** $f'(x)=\cot x$

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2 $\int \frac{x^3+2x^2+3x+2}{x^2+1}dx = \ldots$

A $\frac{x^2}{2}+2x+\log_e(x^2+1)+C$

B $\frac{x^2}{2}+2x+\tan^{-1}x+C$

C $\frac{x^2}{2}+2x+\log_e\sqrt{x^2+1}+C$

D $\frac{x^2}{2}+2x+\tan^{-1}\frac{x}{2}+C$

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3 Evaluate:

(a) $\int_0^2 \frac{dx}{x+1}$ (b) $\int_2^4 \frac{3}{4x-2}dx$ (c) $\int_0^2 \frac{2x+1}{x^2+x+1}dx$ (d) $\int_1^2 \frac{2x+1}{2x-1}dx$

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4 **(a)** Differentiate $y = \log_e\left(x + \sqrt{x^2 - a^2}\right)$, $x > |a|$ with respect to x.

(b) Hence find $\int \frac{dx}{\sqrt{x^2 - a^2}}$, $x > |a|$.

INTEGRATION INVOLVING LOGARITHMIC FUNCTIONS

5 **(a)** Differentiate $y = \log_e\left(x + \sqrt{x^2 + a^2}\right)$ with respect to x. **(b)** Hence find $\int \frac{dx}{\sqrt{x^2 + a^2}}$.

6 Use the integrals in questions **4** and **5** to find the following.

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

6 Use the integrals in questions **4** and **5** to find the following.

(d) $\int \frac{dx}{\sqrt{x^2+6x+13}}$ (e) $\int \frac{dx}{\sqrt{x^2-5x+7}}$ (f) $\int \frac{dx}{\sqrt{x^2+x+1}}$