LAWS OF LOGS

1. Simplify $\dfrac{\log_b 9a^2}{\log_b 3a}$, where $a > 0$ and $b > 0$.

   A.   2

   B. $3a$

   C. $\log_b 3a$

   D. $\log_b(9a^2 - 3a)$ **2**

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
A	3.3	A/B	0	0	NC	A28	2012 P1 Q20

2. Evaluate $\log_5 2 + \log_5 50 - \log_5 4$. **3**

Part	Marks	Level	Calc.	Content	Answer	U3 OC3
	2	C	NC	A28	2	2000 P1 Q9
	1	A/B	NC	A28		

$\bullet^1$ pd: use $\log_a x + \log_a y = \log_a xy$ $\bullet^2$ pd: use $\log_a x - \log_a y = \log_a \frac{x}{y}$ $\bullet^3$ pd: use $\log_a a = 1$	$\bullet^1$ $\log_5 100 - \log_5 4$ $\bullet^2$ $\log_5 25$ $\bullet^3$ 2

3. (a) Given that $\log_4 x = P$, show that $\log_{16} x = \frac{1}{2}P$.   **3**

(b) Solve $\log_3 x + \log_9 x = 12$.   **3**

Part	Marks	Level	Calc.	Content	Answer	U3 OC3
(a)	3	A	CN	A28	proof	2010 P2 Q7
(b)	3	A	CN	A32	$x = 3^8 (= 6561)$	

- $\bullet^1$ ss: convert from log to exponential form
- $\bullet^2$ ss: know to and convert back to log form
- $\bullet^3$ pd: process and complete

- $\bullet^4$ ss: use appropriate strategy
- $\bullet^5$ pd: start solving process
- $\bullet^6$ pd: complete process via log to expo form

- $\bullet^1$ $x = 4^P$
- $\bullet^2$ $\log_{16} x = \log_{16} 4^P$
- $\bullet^3$ $\log_{16} x = P \times \log_{16} 4$ and complete

- $\bullet^4$ $\log_3 x + \frac{1}{2}\log_3 x = 12$
- $\bullet^5$ $\log_3 x = 8$
- $\bullet^6$ $x = 3^8 (= 6561)$

4. Given $x = \log_5 3 + \log_5 4$, find algebraically the value of x.   **4**

Part	Marks	Level	Calc.	Content	Answer	U3 OC3
	1	C	NC	A31		1998 P1 Q19
	3	A/B	NC	A28		
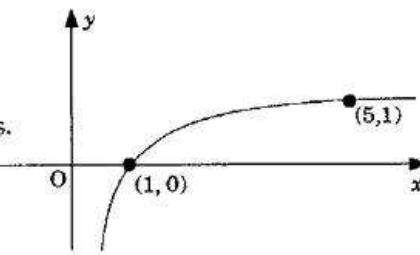
- $\bullet^1$ $x = \log_5 12$
- $\bullet^2$ $5^x = 12$
- $\bullet^3$ $\log 5^x = \log 12$
- $\bullet^4$ $\dfrac{\log_{10} 12}{\log_{10} 5}$ or $\dfrac{\log_e 12}{\log_e 5}$ or $\dfrac{\log 12}{\log 5} = 1.54$

5. The diagram shows a sketch of part of the graph of $y = \log_5 x$.

(a) Make a copy of the graph of $y = \log_5 x$.
 On your copy, sketch the graph of $y = \log_5 x + 1$.
 Find the coordinates of the point where it crosses the x-axis.

3

(b) Make a second copy of the graph of $y = \log_5 x$.
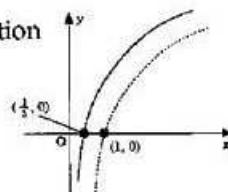 On your copy, sketch the graph of $y = \log_5 \dfrac{1}{x}$.

2

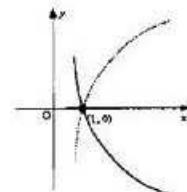| Part	Marks	Level	Calc.	Content	Answer	U3 OC3
(a)	2	C	NC	A32		1994 P1 Q16
(a)	1	A/B	NC	A3		
(b)	2	A/B	NC	A28, A3		

•¹ sketch of new function

•² $\log_5 x + 1 = 0$

•³ $\left(\frac{1}{5}, 0\right)$

•⁴ $\log_5 \frac{1}{x} = -\log_5 x$

•⁵ reflect in x-axis

6. Solve $\log_b x - \log_b 7 = \log_b 3$ for $x > 0$.

   A. $x = 21$

   B. $x = 10$

   C. $x = \frac{7}{3}$

   D. $x = \frac{3}{7}$

2

Key	Outcome	Grade	Facility	Disc.	Calculator	Content	Source
A	3.3	A/B	0.64	0.59	CN	A28, A32	HSN 175

$$\log_b x - \log_b 7 = \log_b 3$$

$$\log_b \frac{x}{7} = \log_b 3$$

$$\frac{x}{7} = 3$$

$$x = 21.$$

Remember
• $\log_b x - \log_b y = \log_b \frac{x}{y}$
• $\log_b x = \log_b y \Leftrightarrow x = y$.

Option $\boxed{A}$

7. Find x if $4\log_x 6 - 2\log_x 4 = 1$. **3**

Part	Marks	Level	Calc.	Content	Answer	U3 OC3
	3	C	NC	A32, A28, A31	$x = 81$	2001 P1 Q8

$\bullet^1$ pd: use log-to-index rule $\bullet^2$ pd: use log-to-division rule $\bullet^3$ ic: interpret base for $\log_x a = 1$ and simplify	$\bullet^1$ $\log_x 6^4 - \log_x 4^2$ $\bullet^2$ $\log_x \frac{6^4}{4^2}$ $\bullet^3$ all processing leading to $x = 81$

[END OF QUESTIONS]