127. If $\log_a x = 3$ and $\log_a y = 4$, evaluate $\left(\log_a \frac{1}{xy}\right)^2$.

A. $\frac{1}{49}$

B. 1

C. 14

D. 49

128. Simplify: $e^{\ln a}$

A. a

B. e^a

C. $\ln a$

D. ae

129. Solve algebraically: $\log_2 x + \log_2(x-7) = 3$ **(5 marks)**

AUG 2002

130. Change $\log_4 c = x$ to exponential form.

A. $x^4 = c$

B. $4^x = c$

C. $4^c = x$

D. $c^x = 4$

131. Determine the domain of $y = 2\log_4(x-1)+5$.

A. $x > 1$

B. $x > 4$

C. $x > 5$

D. all real numbers

132. Solve: $25^{x+3} = 125^{2x-1}$

A. $-\frac{16}{3}$

B. 1

C. $\frac{11}{8}$

D. $\frac{9}{4}$

133. Solve: $\log_4(x^2+1) - \log_4 6 = \log_4 5$

A. $\sqrt{10}$

B. $\pm\sqrt{10}$

C. $\sqrt{29}$

D. $\pm\sqrt{29}$

134. Determine the x-intercept of $y = \log_2(x+4)+1$.

A. -3

B. -3.5

C. -3.9

D. -4

135. Max invests \$5 000 at an interest rate of 6% per annum, compounded monthly. Which expression represents the amount of Max's investment after t years?

A. $5\,000(1.06)^{12t}$

B. $5\,000(1.005)^{12t}$

C. $5\,000(1.06)^{t}$

D. $5\,000(1.005)^{\frac{t}{12}}$

136. Which expression is equivalent to $\log(m^2 n)^3$?

A. $6\log m + 3\log n$

B. $6\log m + \log n$

C. $(2\log m + \log n)^3$

D. $\log 3m^2 + \log 3n$

137. Simplify: $\ln e^{x^5}$

A. 5

B. $5x$

C. x^5

D. $\frac{x}{5}$

138. A radioactive substance is produced from nuclear fallout. If 250 g of this substance decays to 150 g in 30 years, what is the half-life of this substance? (Solve algebraically using logarithms.) (Answer accurate to at least 2 decimal places.) **(5 marks)**

139. A relation has the equation $\log(x-y)+\log(x+y) = \log 25$.

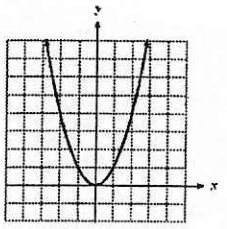
a) Determine an equation of the relation without logarithms. **(2 marks)**

b) Graph the relation $\log(x-y)+\log(x+y) = \log 25$ on the grid provided. Clearly show the asymptotes with broken lines. **(3 marks)**

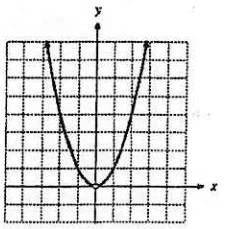
SPECS 2002

140 Which of the following is a graph of $\log_x y = 2$?

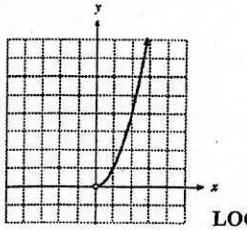
A.



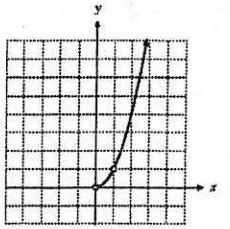
B.



C.



D.



141. Evaluate: $\log_{5.3} 210$

A. 0.31
B. 1.60
C. 2.31
D. 3.21

142. Solve: $27^{x+2} = \left(\frac{1}{3}\right)^{3-6x}$

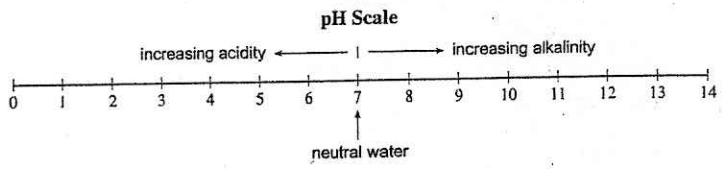
A. $-\frac{1}{3}$
B. $\frac{1}{7}$
C. $\frac{5}{3}$
D. 3

JAN 2003

143. Determine an equation of the asymptote of $f(x) = 2^{x-1} + 3$.

A. $y = 2$
B. $y = -2$
C. $y = 3$
D. $y = -3$

144. The pH scale measures the acidity (0–7) or alkalinity (7–14) of a solution. It is a logarithmic scale in base 10. Thus, a pH of 12 is 10 times more alkaline than a pH of 11. If bleach has a pH of 13, how many times more alkaline is it than blood which has a pH of 8?



A. 1.625
B. 5
C. 50
D. 100 000

145. If $\log_3(m+n) = 2$, $(m+n) > 0$, express m in terms of n.

A. $m = 9 - n$
B. $m = 6 - n$
C. $m = \frac{9}{n}$
D. $m = \frac{6}{n}$

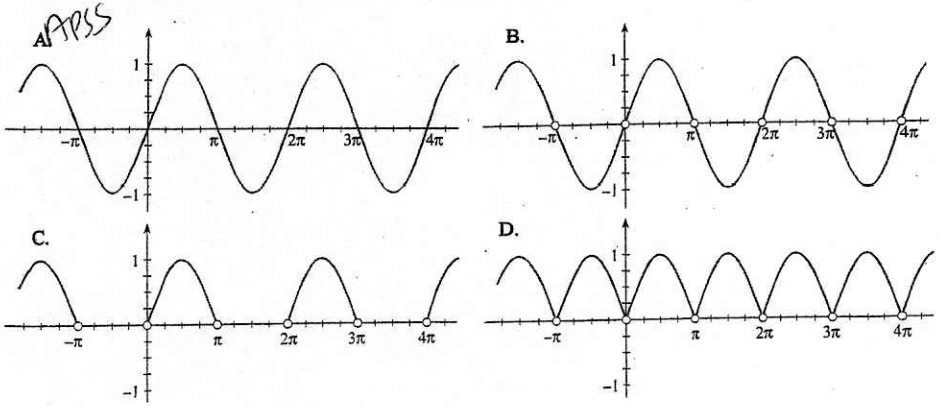
146. If $B = \frac{A}{C^2}$, determine an expression for $\log B$.

A. $\log A - 2\log C$
B. $\log A - \log 2C$
C. $\frac{\log A}{2\log C}$
D. $\frac{\log A - \log C}{2}$

147. A radioactive substance decays continuously according to the formula $N = Ce^{kt}$, where N is the final amount, C is the initial amount, k is a constant, and t is the time in years. If 50 grams of the substance decays to 20 grams in 10 years, determine the value of k.

A. –0.0916
B. –0.0398
C. 0.0610
D. 0.0916

148. Which graph best represents the function $\log y = \log(\sin x)$?



149. Solve algebraically: $2\log(3-x) = \log 4 + \log(6-x)$

JUN 2003

150. Evaluate: $\log_2 700$

A. 1.42
B. 2.54
C. 3.37
D. 9.45

151. Change to exponential form: $\log_x 125 = \frac{3}{2}$

A. $125 = x^{\frac{3}{2}}$

B. $125 = \left(\frac{3}{2}\right)^x$

C. $x^{125} = \frac{3}{2}$

D. $125^{\frac{3}{2}} = x$

152. Determine the domain of the function $y = \log(3x - 5)$.

A. $x > -\frac{5}{3}$

B. $x > -\frac{3}{5}$

C. $x > \frac{3}{5}$

D. $x > \frac{5}{3}$

153. Express as a single logarithm:

$\log a - 2\log b - \log c$

A. $\log \frac{ac}{2b}$

B. $\log \frac{ac}{b^2}$

C. $\log \frac{a}{2bc}$

D. $\log \frac{a}{b^2 c}$

154. Solve for x: $8^{x-1} = \left(\frac{1}{16}\right)^{5-x}$

A. $-\frac{19}{4}$

B. -3

C. $\frac{23}{7}$

D. 17

155. An earthquake off the coast of Alaska measured 6.4 on the Richter scale. Another earthquake near Japan was 50 times as intense. What was the Richter scale reading for the earthquake near Japan?

A. 7.1
B. 7.9
C. 8.1
D. 10.9

156. Which expression gives the amount that an investment of P dollars will grow to after 4 years if it is compounded semi-annually at a rate of 5% per annum?

A. $P(1.05)^4$
B. $P(1.025)^4$
C. $P(1.05)^8$
D. $P(1.025)^8$

157. Given that $y_1 = \log_a 0.4$ and $y_2 = \log_a 4$, where $0 < a < 1$, which of the following **must** be true?

A. $y_1 < y_2$
B. $y_1 > y_2$
C. $0.4 < y_1 < 4$
D. $0.4 < y_2 < 4$

158. If 200 g of a substance decays to 17 g in 28 days, determine the half-life of this substance. (Solve algebraically using logarithms. Answer accurate to at least 2 decimal places.)

JAN 2004

159. Evaluate: $\log_3 59.2$

A. 0.27
B. 1.30
C. 3.71
D. 19.73

160. Determine the domain of $y = \log_a(-x)$.

A. $x < 0$
B. $x > 0$
C. $x \le 0$
D. $x \ge 0$

161. Express as a single logarithm:

$\log A - 3\log B + \log C$

A. $\log \frac{AC}{3B}$

B. $\log \frac{AC}{B^3}$

C. $\log \frac{A}{B^3 C}$

D. $\log(A - 3B + C)$

162. If the point $(2, 9)$ is on the graph of $y = a^x$, what point must be on the graph of $y = \log_a x$?

A. $\left(2, \frac{1}{9}\right)$

B. $(2, 9)$

C. $(9, -2)$

D. $(9, 2)$

163. Solve: $\log_2(3-2x) - \log_2(2-x) = \log_2 3$

A. -2

B. $\frac{1}{2}$

C. 3

D. no solution

164. The number of insects in a colony can triple in 7 weeks. After 50 weeks, how many times greater will the number of insects be than after 20 weeks?

A. 81
B. 110.87
C. 243
D. 2.06×10^{14}

165. A radioactive substance decays from 600 g to 105 g in twelve days. Determine the half-life for this substance.

A. 4.77 d
B. 5.27 d
C. 7.43 d
D. 30.17 d

166. Solve algebraically using logarithms: $2^x = 5^{x+1}$
(Answer accurate to at least 2 decimal places.)

167. Give the domain of $f(x) = \log_7(x+6) + 12$.

A. $x > 6$
B. $x > -6$
C. $x > 12$
D. $x > -12$

168. Express $\log_5 30$ using logarithms in base 4.

A. $\log_4 30 - \log_4 5$

B. $\frac{\log_4 5}{\log_4 30}$

C. $\frac{\log_4 30}{\log_4 5}$

D. $\frac{\log_{30} 4}{\log_5 4}$

169. Solve: $\left(\frac{1}{9}\right)^x = 27^{2-x}$

A. -6

B. $\frac{6}{5}$

C. 2

D. 6

170. Which expression is equivalent to $\log \frac{x}{2y^3}$?

A. $\log x - \log 2 + 3\log y$
B. $\log x - 3\log 2 + 3\log y$
C. $\log x - \log 2 - 3\log y$
D. $\log x - 3\log 2 - 3\log y$

171. Solve: $\log_2 x + \log_2(x-1) = 3$

A. 2.37
B. 3
C. 3.37
D. 3.5

172. The formula $A = P(1.09)^t$ is an example of exponential growth with base 1.09. Determine an equivalent continuous growth formula using base e, $A = Pe^{kt}$.

A. $A = Pe^{0.086t}$
B. $A = Pe^{1.086t}$
C. $A = Pe^{0.86t}$
D. $A = Pe^{1.86t}$

173. Determine an exponential function in the form $y = 3^{x-h} + k$ with y-intercept 5 and asymptote $y = -4$.

A. $y = 3^{x-4} + 5$

B. $y = 3^{x-2} - 4$

C. $y = 3^{x-5} - 4$

D. $y = 3^{x+2} - 4$

174. The population of a nest of ants can multiply threefold (triple) in 8 weeks. If the population is now 12 000, how many weeks will it take for the population to reach 300 000 ants?

(Solve algebraically using logarithms. Answer accurate to at least 2 decimal places.)

LOGARITHMS

1	D
2	D
3	B
4	B
5	C
6	D
7	C
8	15.6 years
9	A
10	C
11	A
12	B
13	B
14	D
15	D
16	B
17	x = -2
18	A
19	A
20	D
21	C
22	B
23	A
24	A
25	4 165 600
26	B
27	A
28	A
29	D
30	A
31	B
32	A
33	x = 5/2
34	C
35	A
36	B
37	A
38	A
39	C
40	B
41	92.88 weeks
42	B
43	A
44	C
45	A
46	B
47	B
48	D
49	D
50	A
51	D
52	D
53	D
54	B
55	C
56	137 years
57	$y = 8x$, $x > 0, y > 0, y \neq 1$
58	A
59	C
60	A
61	C
62	A
63	B
64	D
65	$y = \frac{x^2}{27}$, $x > 0, y > 0, y \neq 1$
66	B
67	D
68	A
69	C
70	A
71	D
72	D
73	C
74	D
75	A
76	C
77	A
78	D
79	A
80	A
81	C
82	B
83	D
84	B
85	B
86	D
87	C
88	$y = -2$, $(0,3), (\log_8 2 - 1, 0)$
89	36 848 years
90	n = 93.19 h
91	31.59 years
92	D
93	A
94	B
95	D
96	B
97	D
98	C
99	C
100	A
101	26 weeks
102	B
103	D
104	A
105	B
106	C
107	D
108	B
109	B
110	130.03 days
111	D
112	C
113	A
114	D
115	D
116	C
117	D
118	C
119	x = -3
120	k = 0.14
121	D
122	A
123	D
124	A
125	B
126	C
127	D
128	A
129	x = 8
130	B
131	A
132	D
133	D
134	B
135	B
136	A
137	C
138	40.71 years
139	$x^2 - y^2 = 25$
140	D
141	D
142	D
143	C
144	D
145	A
146	A
147	A
148	C
149	x = -3
150	D
151	A
152	D
153	D
154	D
155	C
156	D
157	B
158	7.87 days
159	C
160	A
161	B
162	D
163	D
164	B
165	A
166	x = -1.76
167	B
168	C
169	D
170	C
171	C
172	A
173	D
174	23.44 weeks