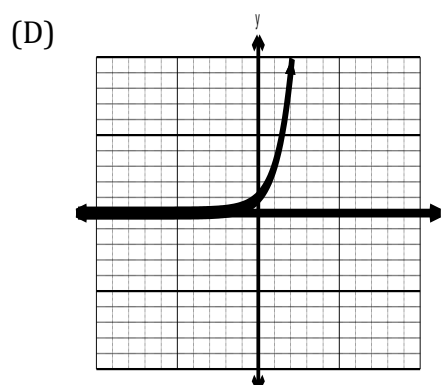
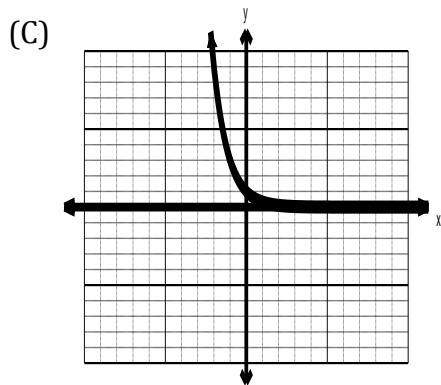
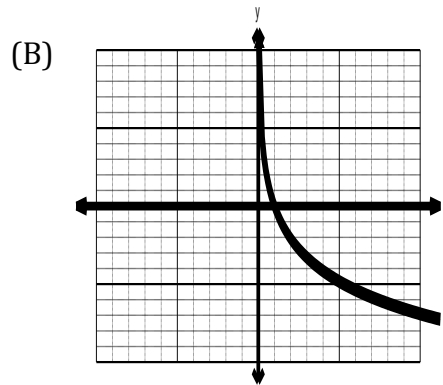
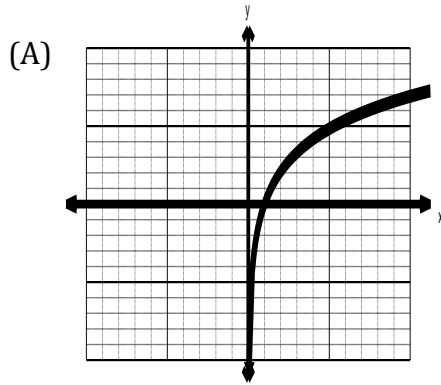


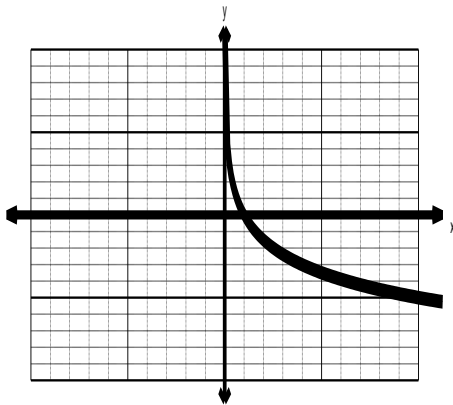
**Part I: Multiple Choice.** Place the correct answer in the corresponding blank at the end of this section.

1. What is the domain for  $y = \log_2 x$ ?  
(A)  $\{x \mid x > 0, x \in R\}$  (B)  $\{x \mid x \geq 0, x \in R\}$   
(C)  $\{x \mid x \in R\}$  (D)  $\{x \mid x > 2, x \in R\}$
2. What is the domain for  $y = -5 \ln x$ ?  
(A)  $\{x \mid x > 0, x \in R\}$  (B)  $\{x \mid x \geq 0, x \in R\}$   
(C)  $\{x \mid x \in R\}$  (D)  $\{x \mid x > 5, x \in R\}$
3. What is the range for  $y = 7 \log x$ ?  
(A)  $\{y \mid y > 0, y \in R\}$  (B)  $\{y \mid y \geq 0, y \in R\}$   
(C)  $\{y \mid y \in R\}$  (D)  $\{y \mid y > 7, y \in R\}$
4. What is the range for  $y = 6 \ln x$ ?  
(A)  $\{y \mid y > 0, y \in R\}$  (B)  $\{y \mid y \geq 0, y \in R\}$   
(C)  $\{y \mid y \in R\}$  (D)  $\{y \mid y > 6, y \in R\}$
5. What is the  $y$ -intercept for  $y = 2 \log_4 x$ ?  
(A) 0 (B) 2 (C) 4 (D) No  $y$ -intercept
6. What is the  $y$ -intercept for  $y = -4 \ln x$ ?  
(A) -4 (B) 0 (C)  $e$  (D) No  $y$ -intercept

7. Which graph best represents  $y = 3\ln x$ ?



8. Which function represents the graph below?



(A)  $y = \left(\frac{1}{5}\right)^x$

(B)  $y = 5^x$

(C)  $y = -5\log x$

(D)  $y = 5\log x$

9. What is the  $x$ -intercept of  $y = 6\log_2 x$ ?
- (A) 0                      (B) 1                      (C) 2                      (D) 6
10. What is the  $x$ -intercept of  $y = -8\ln x$ ?
- (A) -8                      (B) 1                      (C)  $e$                       (D) No  $x$ -intercept
11. What is the end behaviour of  $y = 4\log x$ ?
- (A) extends from QI to QII                      (B) extends from QII to QI  
(C) extends from QI to QIV                      (D) extends from QIV to QI
12. What is the end behaviour of  $y = -2\ln x$ ?
- (A) extends from QI to QII                      (B) extends from QII to QI  
(C) extends from QI to QIV                      (D) extends from QIV to QI
13. What is  $e^x = 18$  in logarithmic form?
- (A)  $\ln x = 18$                       (B)  $\ln 18 = x$   
(C)  $\log_x 18 = e$                       (D)  $\log_{18} x = e$
14. What is  $\log_2 \left( \frac{1}{16} \right) = -4$  in exponential form?
- (A)  $2^{-4} = \frac{1}{16}$                       (B)  $\left( \frac{1}{16} \right)^{-4} = 2$   
(C)  $(-4)^2 = \frac{1}{16}$                       (C)  $\left( \frac{1}{16} \right)^2 = -4$
15. What is the logarithmic form of  $3^{-4} = \frac{1}{81}$ ?
- (A)  $\log_3(-4) = \frac{1}{81}$                       (B)  $\log_{\frac{1}{81}}(-4) = 3$   
(C)  $\log_3 \left( \frac{1}{81} \right) = -4$                       (D)  $\log_{\frac{1}{81}} 3 = -4$

16. What is the logarithmic form of  $b^e = n$ ?
- (A)  $\log_b e = n$  (B)  $\log_e b = n$   
 (C)  $\log_n b = e$  (D)  $\log_b n = e$
17. What is the value of  $\log_5 125$ ?
- (A) 3 (B) 4 (C) 5 (D) 25
18. What is the value of  $\log_2 \left( \frac{1}{32} \right)$ ?
- (A) -5 (B) -4 (C) 4 (D) 5
19. What is the value of  $x$ , given  $2^x = 6$ ?
- (A) 0.39 (B) 0.48 (C) 2.58 (D) 3
20. What is the value of  $x$ , given  $3^{x-1} = 14$ ?
- (A)  $\frac{\log 14}{\log 3} + 1$  (B)  $\frac{\log 14}{\log 3} - 1$   
 (C)  $\frac{\log 3}{\log 14} - 1$  (D)  $\frac{\log 3}{\log 14} + 1$
21. What is the value of  $x$ , given  $e^x = 4$ ?
- (A) 0.6 (B) 1.4 (C) 2.7 (D) 54.6
22. What is the value of  $\log_6 25$ ?
- (A) 0.5566 (B) 1.5069 (C) 1.7964 (D) 4.1667
23. What is the value of  $\log_4 27$ ?
- (A) 0.4206 (B) 1.4533 (C) 2.3774 (D) 6.75
24. What is  $2\log_2 4 + \log_2 2$  as a single logarithm?
- (A)  $\log_2 4$  (B)  $\log_2 8$  (C)  $\log_2 16$  (D)  $\log_2 32$

25. What is  $2\log_3 5 + 3\log_3 2$  as a single logarithm?
- (A)  $\log_3 60$       (B)  $\log_3 1.7$       (C)  $\log_3 150$       (D)  $\log_3 200$
26. What is the value of  $\log_8 16 + \log_8 32$ ?
- (A)  $-\frac{1}{3}$       (B)  $\frac{1}{3}$       (C)  $-3$       (D)  $3$
27. What is the value of  $\log_4 4 + \log_2 8$ ?
- (A)  $3$       (B)  $4$       (C)  $5$       (D)  $6$
28. Which expression is equivalent to  $\log_2 16$ ?
- (A)  $2\log 8$       (B)  $\log_2 8 + \log_2 2$   
 (C)  $\log_2 20 - \log_2 4$       (D)  $\log 2$
29. Which expression is equivalent to  $\log 8$ ?
- (A)  $2\log 4$       (B)  $4\log 2$   
 (C)  $3\log 2$       (D)  $\frac{1}{2}\log 16$
30. The logarithmic regression equation for the height of a tree is  $y = 6.099 + (6.108)\ln x$ , where  $y$  is the height of the tree and  $x$  is the time in years. What is the height of the tree after 60 months?
- (A)  $15.9$       (B)  $17.0$       (C)  $10.4$       (D)  $31.1$
31. The energy released during an earthquake can be determined on the Richter scale using the formula  $\log E = 4.4 + 1.5R$ , where  $E$  is the energy released in joules and  $R$  is the magnitude. How much energy is released for an earthquake with a magnitude of 7?

32. The pH scale is used to measure the acidity of a solution. The pH,  $p(x)$ , is defined by the equation  $p(x) = -\log x$ , where the concentration of hydrogen ions,  $x$ , in a solution is measured in moles per litre (mol/L).
- (i) Black coffee has a pH of 5. What is its hydrogen ion concentration?
- (ii) Baking soda has a pH of 9. In terms of concentration, how much more acidic is black coffee than baking soda?
33. Write  $2\log_5 3 + \log_5 6 - \log_5 27$  as a single log and then evaluate.
34. Write  $\log_3 27 - \log_3 3 + 2\log_3 \left(\frac{1}{9}\right)$  as a single log and then evaluate.
35. Write  $3\log_3 9 - 6\log_3 2$  as a single log and then evaluate.
36. Write  $\log_4 5 + \frac{1}{2}\log_4 16 - \log_4 1.25$  as a single log and then evaluate.
37. Write  $\log_2 35 - \log_2 7 + \log_2 6.4$  as a single log and then evaluate.
38. Solve each of the following equations for  $x$ :
- |                          |                     |
|--------------------------|---------------------|
| (A) $4^{x+1} = 52$       | (B) $9^{2x-3} = 5$  |
| (C) $2^{x+3} = 5^{2x-1}$ | (C) $e^{3x+2} = 34$ |
39. Lori invests \$9000 in her grandchild's college fund. The fund grows at a rate of 8% per year compounded monthly. How long will it take the fund to grow to \$20 000.
40. The population of coyotes in NL is given by the function  $P(t) = 25(3)^{\frac{t}{4}}$ , where  $P(t)$  is the number of coyotes and  $t$  is the time in years. How long will it take for the population to reach 258 animals?
41. Joshua invests \$500 into an account that pays 5% interest compounded quarterly. Write an equation to represent this situation and then use it to determine how long will it take for his investment to reach \$900?
42. Cesium-137 has a half-life of 30 years. If the initial mass of the cesium-137 were 700mg, how long would it take to decrease to 100 mg?

43. Sheldon's solution to a problem is shown below. Identify his mistakes and provide a correct solution:

$$\begin{aligned} & 2\log_2 5 - \log_2 \left(\frac{4}{5}\right) + \frac{1}{2}\log_2 16 \\ &= \log_2 5^2 - \log_2 \left(\frac{4}{5}\right) + \log_2 \left(\frac{16}{2}\right) \\ &= \log_2 25 - \log_2 \left(\frac{4}{5}\right) + \log_2 8 \\ &= \log_2 \left(25 \times \frac{4}{5} \times 8\right) \end{aligned}$$

44. An advertising agency has determined that the number of items sold is related to the amount of money spent on advertising. A logarithmic regression was performed and the results were as follows:

LnReg  
 $y = a + b \ln x$   
 $a = 1500$   
 $b = 315$

- (A) Write the equation based on the result above.
- (B) Use the equation to determine the number of items that will be sold if \$10000 is spent on advertising.

Answers:

- |       |       |       |       |
|-------|-------|-------|-------|
| 1) A  | 2) A  | 3) C  | 4) C  |
| 5) D  | 6) D  | 7) A  | 8) C  |
| 9) B  | 10) B | 11) D | 12) C |
| 13) B | 14) A | 15) C | 16) D |
| 17) A | 18) A | 19) C | 20) A |
| 21) B | 22) C | 23) C | 24) D |
| 25) D | 26) D | 27) B | 28) B |
| 29) C | 30) A |       |       |

31)  $E = 10^{14.9}$

32) i)  $10^{-5}$  or 0.00001    ii)  $10^{-9}$  or 0.000000001

It is  $10^4$  times more acidic (10 000)

33)  $\log_5 2 = 0.4307$     34)  $\log_3 \left(\frac{1}{9}\right) = -2$     35)  $\log_3 \left(\frac{729}{64}\right) = 2.2$

36)  $\log_4 16 = 2$     37)  $\log_2 32 = 5$

38) (a) 1.8502 (b) 1.8662 (c) 1.4605 (d) 0.5088

39) 120 months (10 years)    40) 8.5 years    41) ~16 years

42) 7.63 years

43) Step 1: Divided by 2 instead of having exponent of  $\frac{1}{2}$

Step 3: Multiplied the 25 and the  $\frac{4}{5}$  instead of dividing

$$\begin{aligned} & 2\log_2 5 - \log_2 \left(\frac{4}{5}\right) + \frac{1}{2}\log_2 16 \\ &= \log_2 5^2 - \log_2 \left(\frac{4}{5}\right) + \log_2 16^{\frac{1}{2}} \\ &= \log_2 25 - \log_2 \left(\frac{4}{5}\right) + \log_2 4 \\ &= \log_2 \left(25 \div \frac{4}{5} \times 4\right) \\ &= \log_2 125 \end{aligned}$$

44) (a)  $y = 1500 + 315 \ln x$

(b) 4401 items