

Assignment

Date _____ Period _____

Evaluate each expression.

1) $\log_7 \frac{1}{343}$

2) $\log_4 \frac{1}{16}$

3) $\log_2 1$

4) $\log_2 64$

5) $\log_3 \frac{1}{27}$

6) $\log_7 1$

7) $\log_2 \frac{1}{64}$

8) $\log_3 81$

9) $\log_2 16$

10) $\log_3 243$

11) $\log_4 64$

12) $\log_7 \frac{1}{49}$

13) $\log_6 6$

14) $\log_2 32$

15) $\log_3 1$

16) $\log_2 \frac{1}{16}$

17) $\log_3 \frac{1}{9}$

18) $\log_7 49$

19) $\log_2 4$

20) $\log_4 4$

21) $\log_5 \frac{1}{125}$

22) $\log_2 \frac{1}{8}$

23) $\log_6 216$

24) $\log_3 \frac{1}{243}$

25) $\log_4 \frac{1}{4}$

26) $\log_7 343$

27) $\log_5 \frac{1}{25}$

28) $\log_6 \frac{1}{36}$

29) $\log_4 \frac{1}{64}$

30) $\log_2 8$

31) $\log_4 1$

32) $\log_2 \frac{1}{4}$

33) $\log_5 25$

34) $\log_4 16$

35) $\log_6 36$

36) $\log_6 \frac{1}{216}$

37) $\log_6 1$

38) $\log_5 125$

39) $\log_3 9$

40) $\log_3 27$

Use a calculator to approximate each to the nearest thousandth.

41) $\log_5 43$

42) $\ln 6$

43) $\log_4 4.8$

44) $\log_6 3.3$

45) $\log_2 58$

46) $\log_4 1.7$

47) $\log_2 18$

48) $\log_2 5$

49) $\log_2 30$

50) $\log_2 69$

51) $\log_2 17$

52) $\log_3 3.23$

53) $\log_5 5.6$

54) $\log 17$

55) $\log_7 58$

56) $\log_5 61$

57) $\log_6 26$

58) $\log_7 21$

59) $\log_7 4.6$

60) $\log_2 54$

61) $\log_6 69$

62) $\log 5.3$

63) $\log_7 1.2$

64) $\log_7 5.3$

65) $\log_4 2.2$

66) $\log_4 2.3$

67) $\log 3$

68) $\log_2 25$

69) $\ln 4$

70) $\log_4 39$

71) $\log_2 16$

72) $\log_3 6$

73) $\log_2 12$

74) $\log_3 1.7$

75) $\log_7 31$

76) $\log_5 29$

77) $\log_3 1.9$

78) $\log_6 6.9$

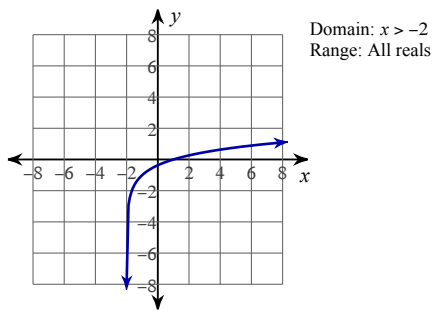
79) $\log_5 3.6$

80) $\log_3 2.8$

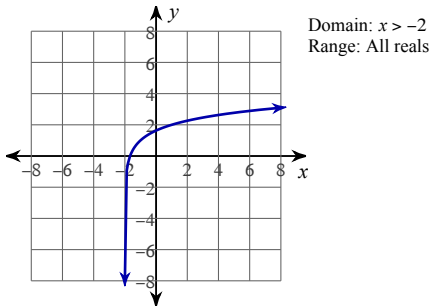
Identify the domain and range of each. Then sketch the graph.

81) $y = \log_3(x + 2) + 1$

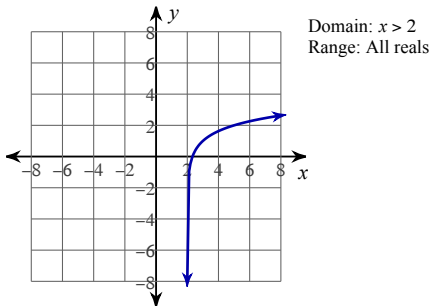
A)



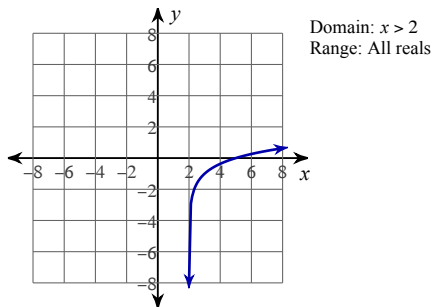
B)



C)

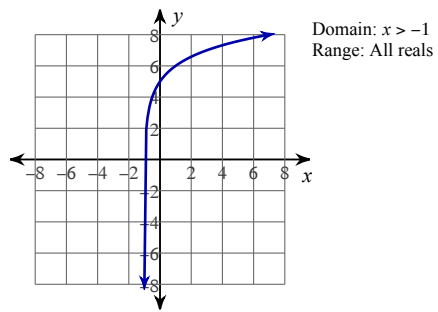


D)

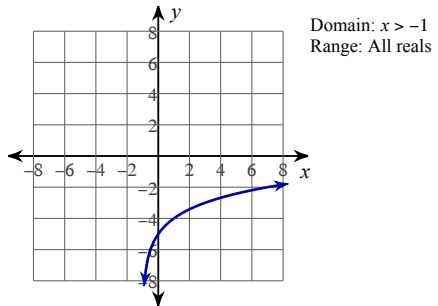


82) $y = \log_2(x - 1) - 5$

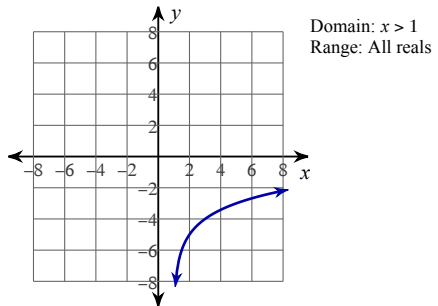
A)



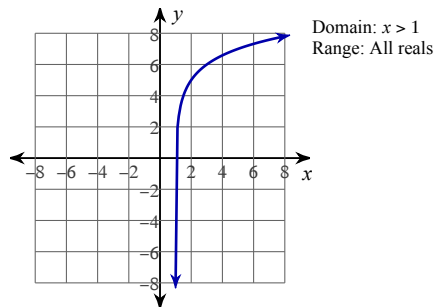
B)



C)

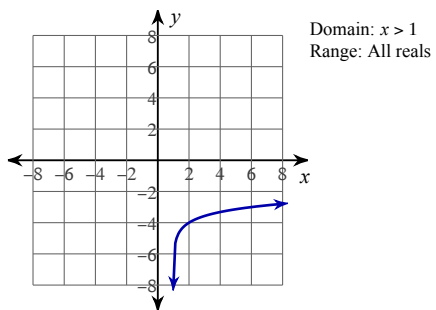


D)

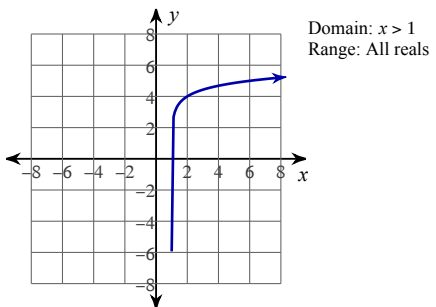


83) $y = \log_5(x - 1) + 4$

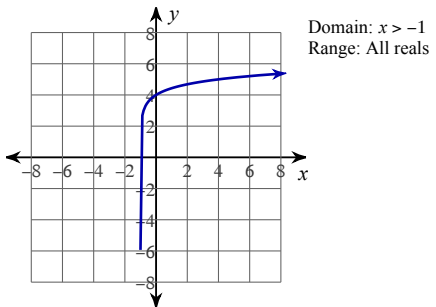
A)



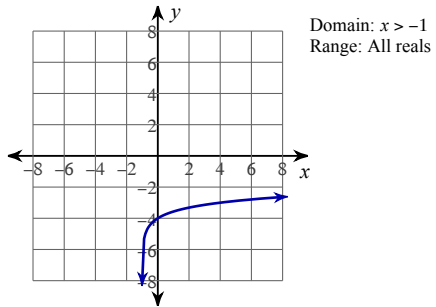
B)



C)

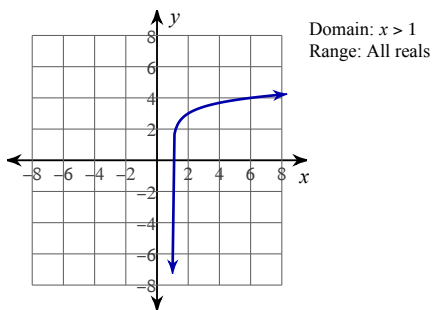


D)

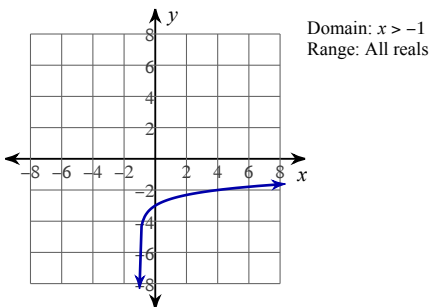


84) $y = \log_5(x - 1) + 3$

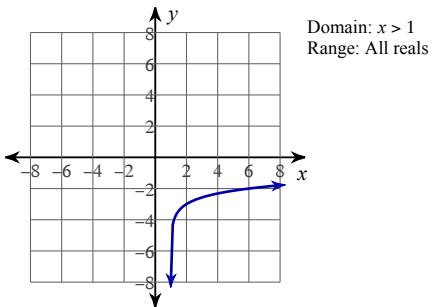
A)



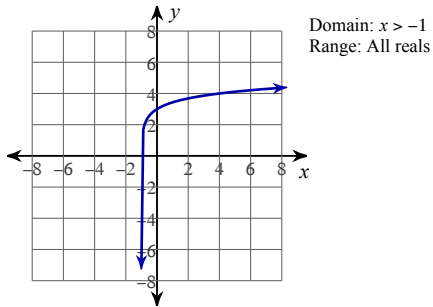
B)



C)

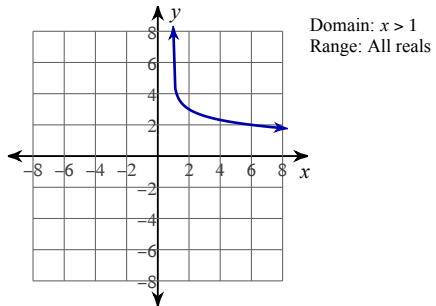


D)

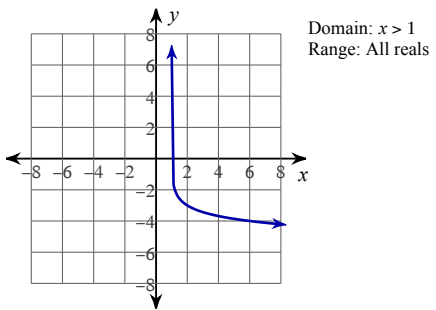


$$85) y = \log_{\frac{1}{5}}(x - 1) + 3$$

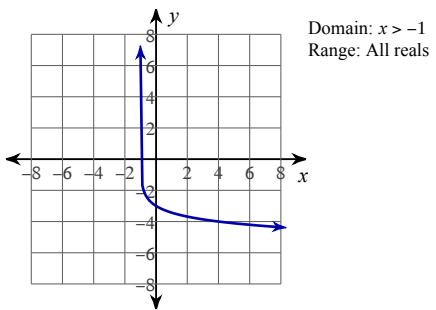
A)



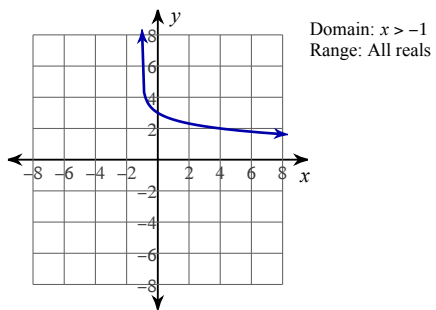
B)



C)

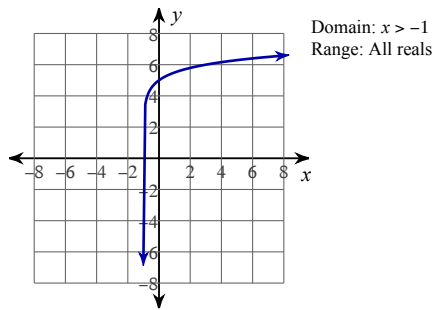


D)

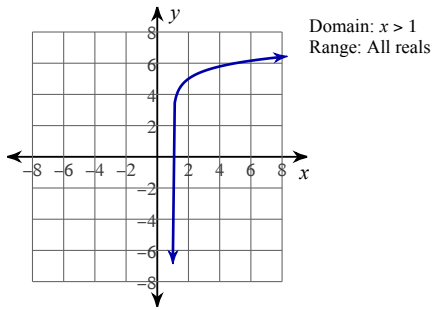


$$86) y = \log_4(x - 1) - 5$$

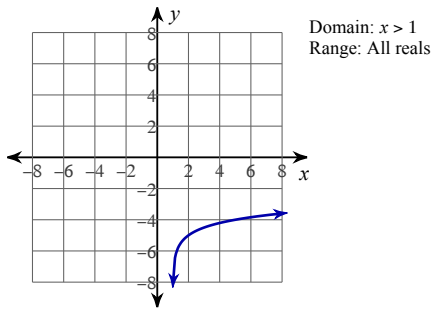
A)



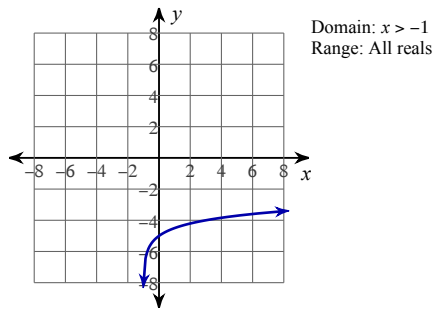
B)



C)

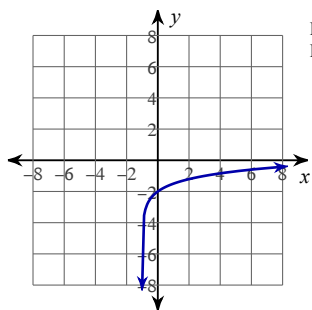


D)



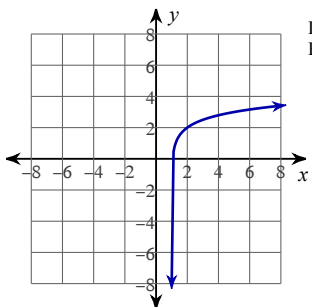
87) $y = \log_4(x - 1) + 2$

A)



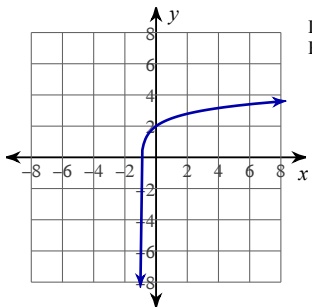
Domain: $x > -1$
Range: All reals

B)



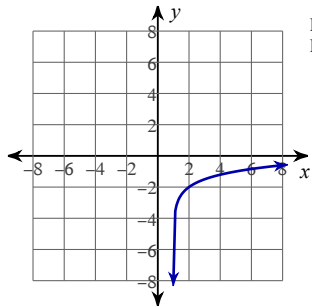
Domain: $x > 1$
Range: All reals

C)



Domain: $x > -1$
Range: All reals

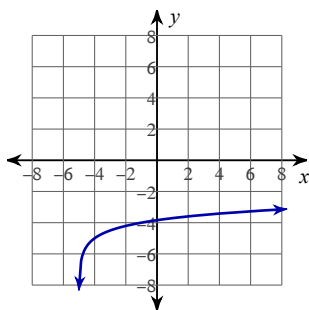
D)



Domain: $x > 1$
Range: All reals

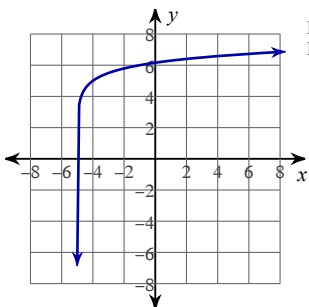
88) $y = \log_4(x + 5) + 5$

A)



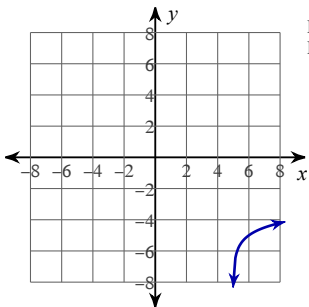
Domain: $x > -5$
Range: All reals

B)



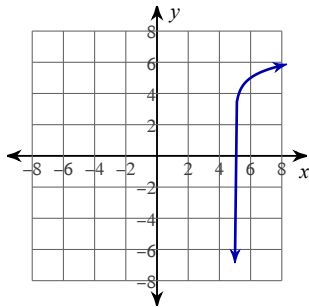
Domain: $x > -5$
Range: All reals

C)



Domain: $x > 5$
Range: All reals

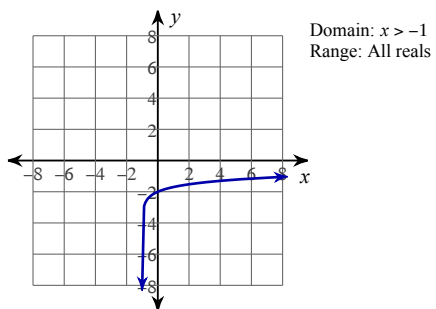
D)



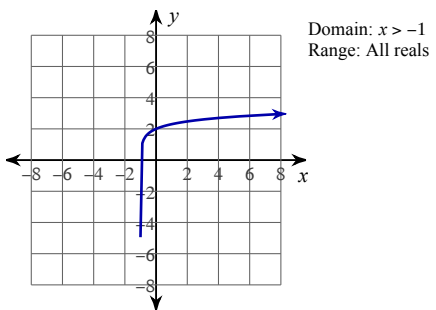
Domain: $x > 5$
Range: All reals

89) $y = \log(x - 1) - 2$

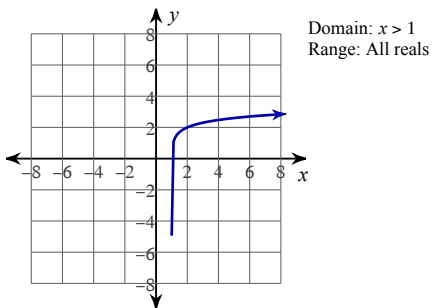
A)



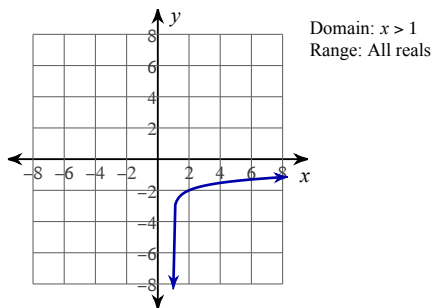
B)



C)

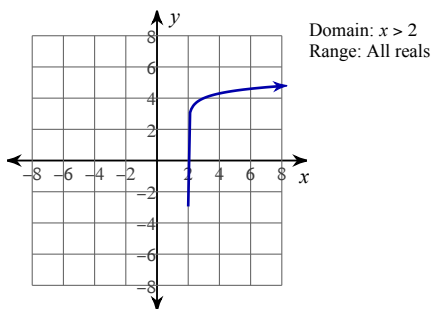


D)

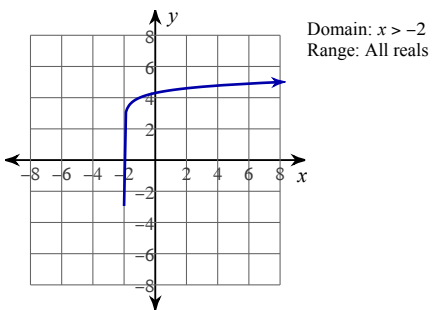


90) $y = \log(x - 2) - 4$

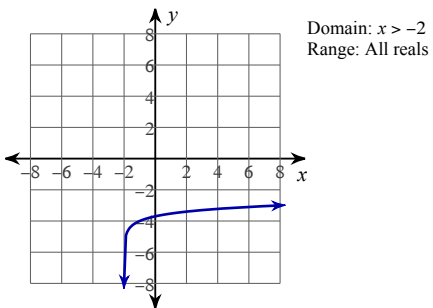
A)



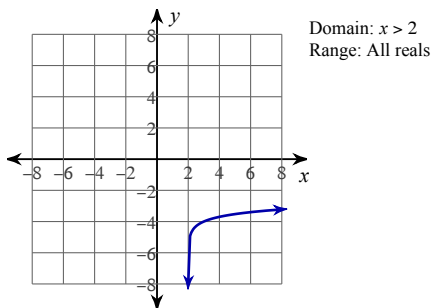
B)



C)

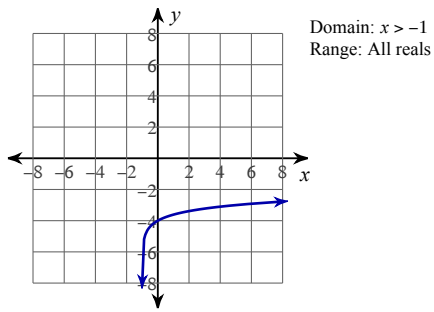


D)

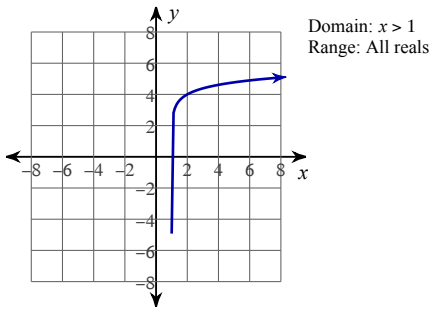


91) $y = \log_6(x - 1) - 4$

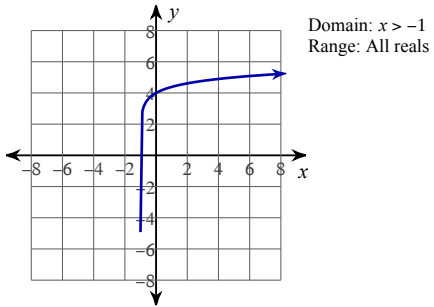
A)



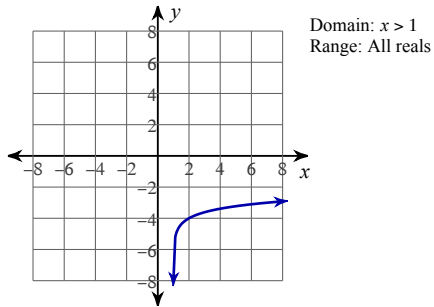
B)



C)

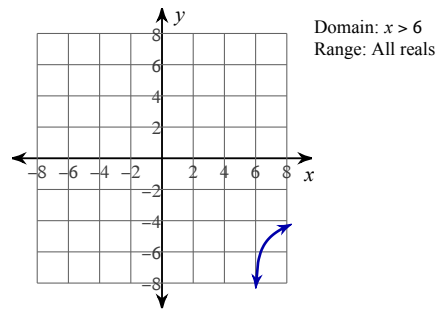


D)

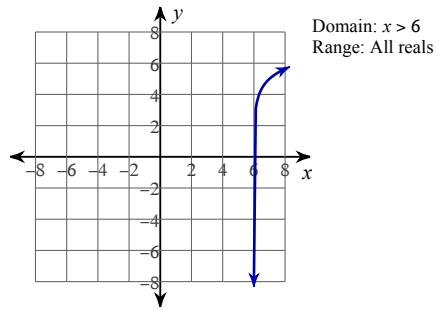


92) $y = \log_3(x + 6) + 5$

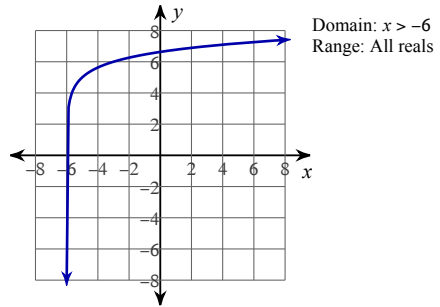
A)



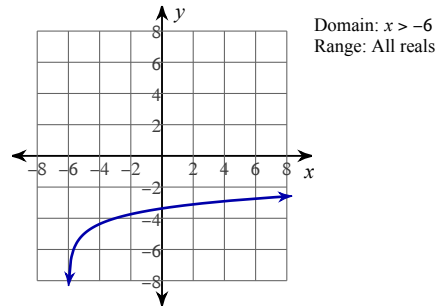
B)



C)

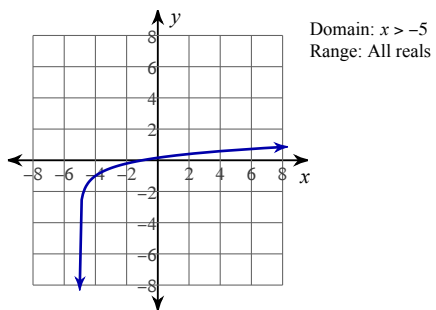


D)

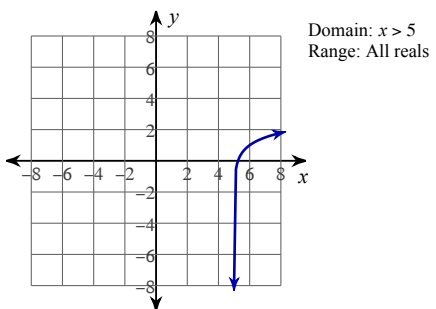


93) $y = \log_4(x + 5) - 1$

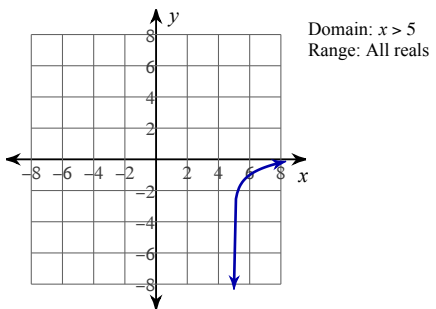
A)



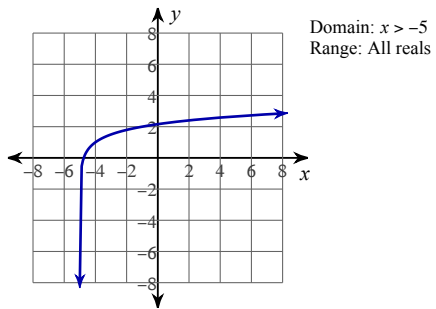
B)



C)

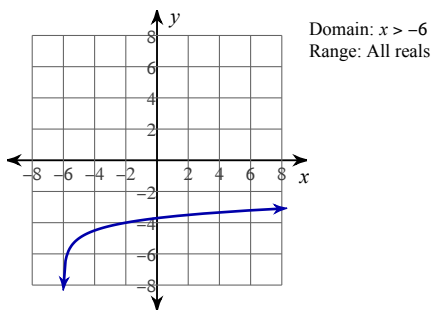


D)

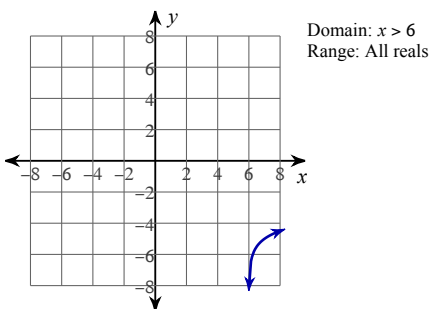


94) $y = \log_4(x + 6) + 5$

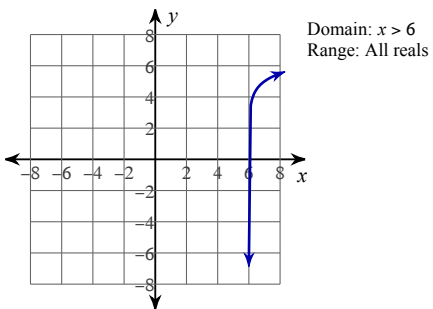
A)



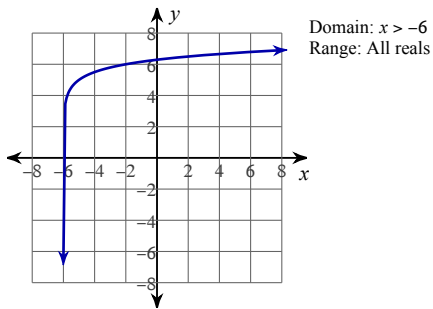
B)



C)

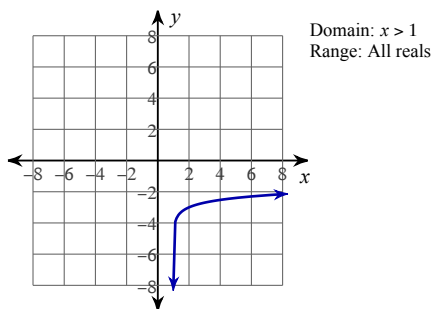


D)

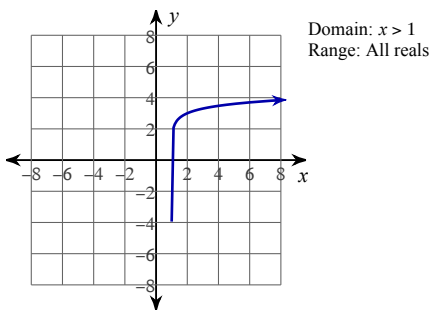


95) $y = \log(x - 1) - 3$

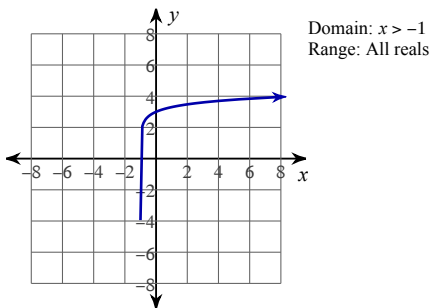
A)



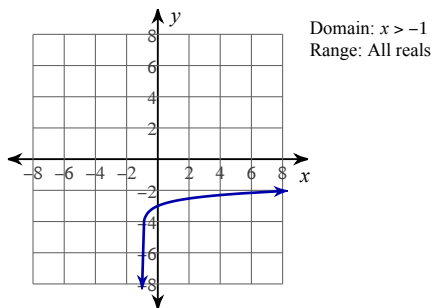
B)



C)

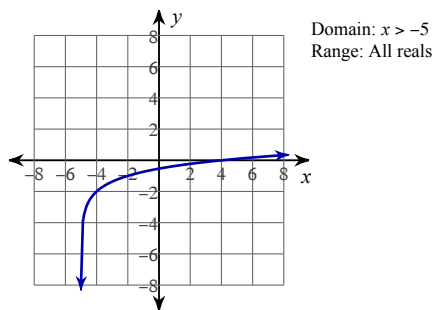


D)

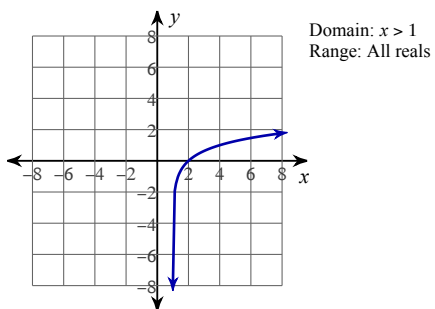


96) $y = \log_3(x - 1)$

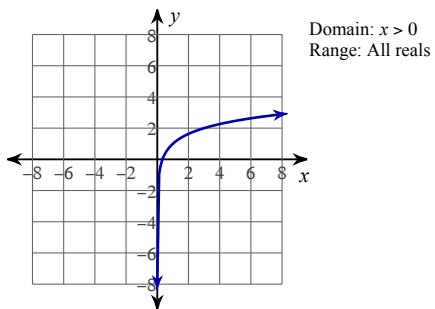
A)



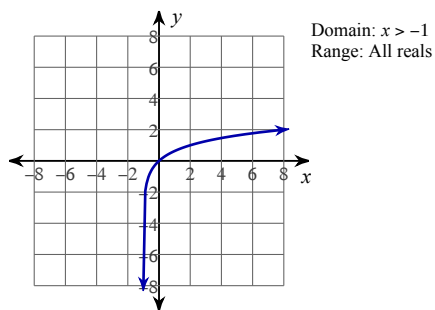
B)



C)

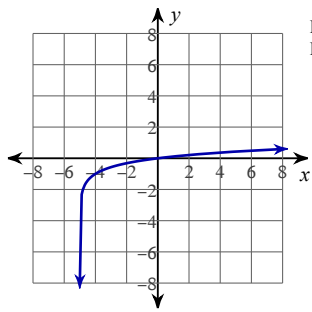


D)



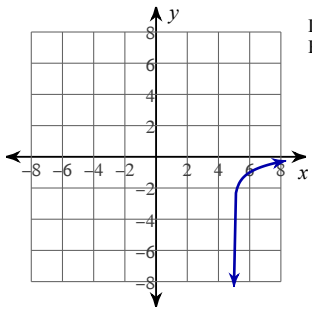
97) $y = \log_5(x + 5) + 1$

A)



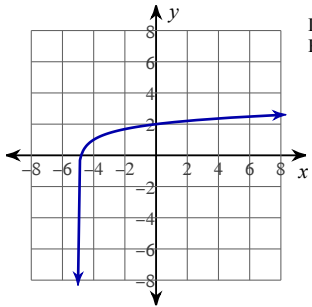
Domain: $x > -5$
Range: All reals

B)



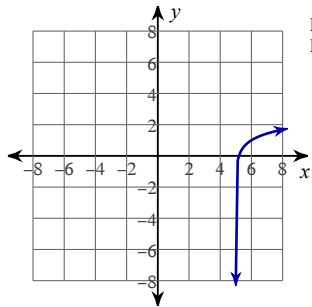
Domain: $x > 5$
Range: All reals

C)



Domain: $x > -5$
Range: All reals

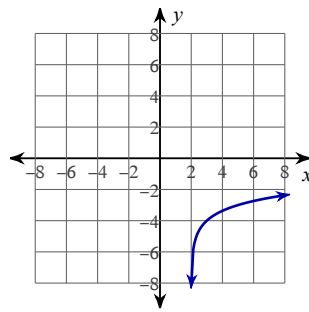
D)



Domain: $x > 5$
Range: All reals

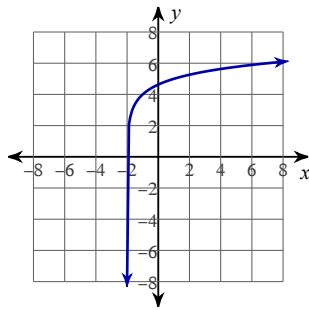
98) $y = \log_3(x - 2) + 4$

A)



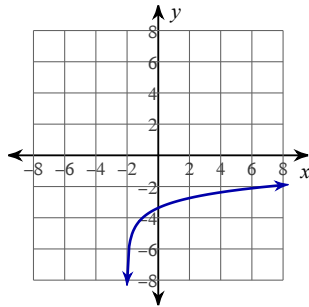
Domain: $x > 2$
Range: All reals

B)



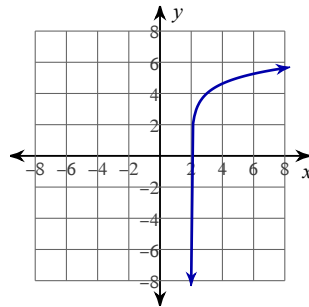
Domain: $x > -2$
Range: All reals

C)



Domain: $x > -2$
Range: All reals

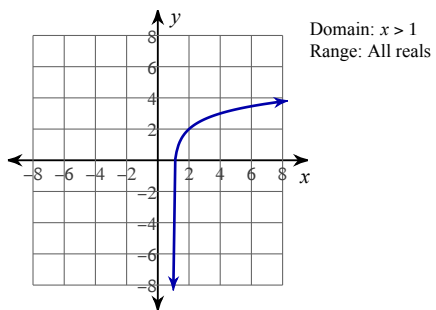
D)



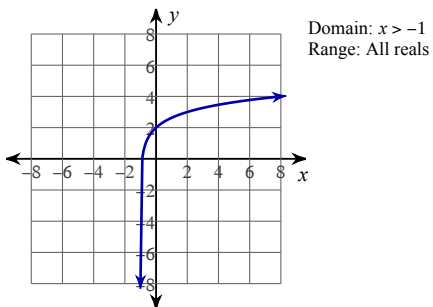
Domain: $x > 2$
Range: All reals

99) $y = \log_3(x - 1) + 2$

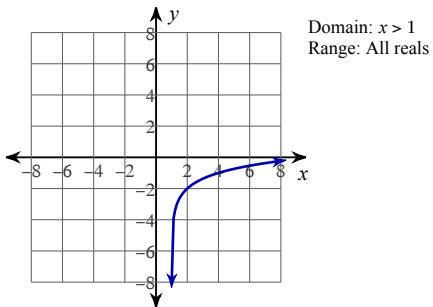
A)



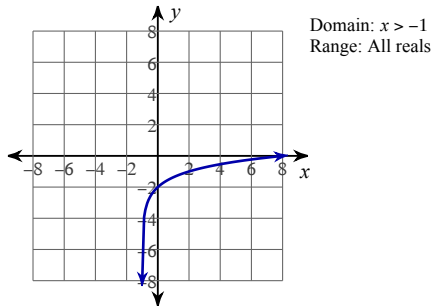
B)



C)

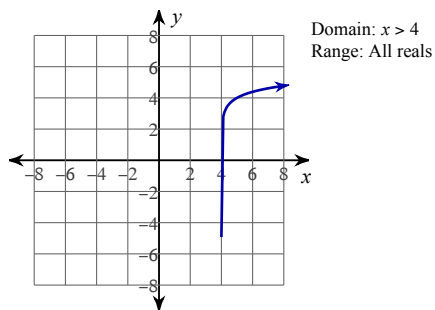


D)

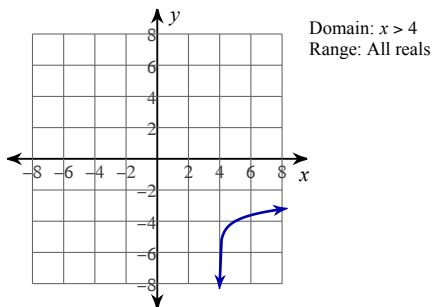


100) $y = \log_6(x + 4) - 4$

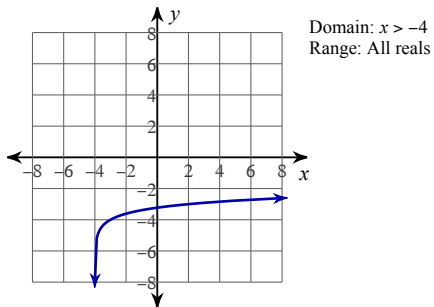
A)



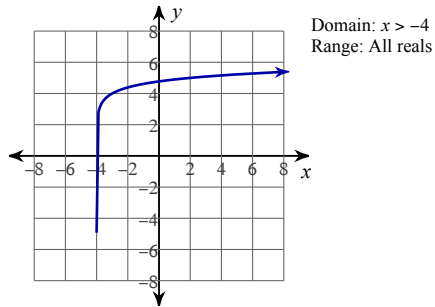
B)



C)

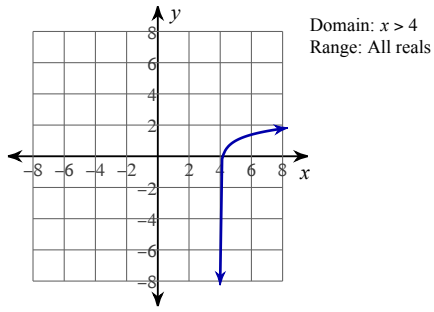


D)

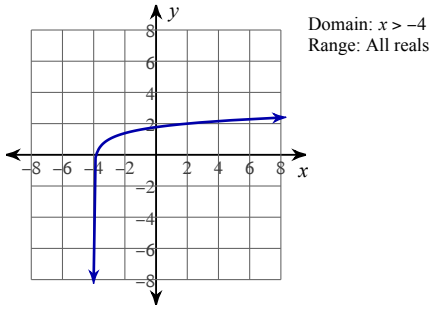


101) $y = \log_6(x + 4) - 1$

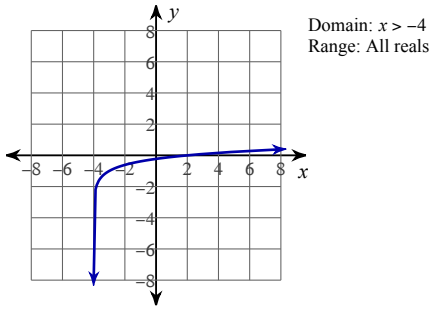
A)



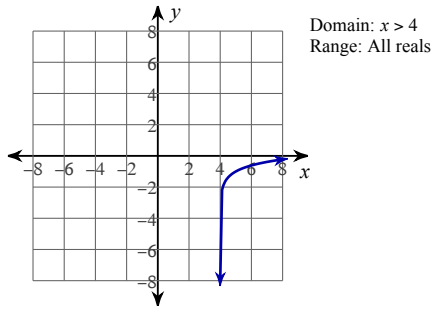
B)



C)

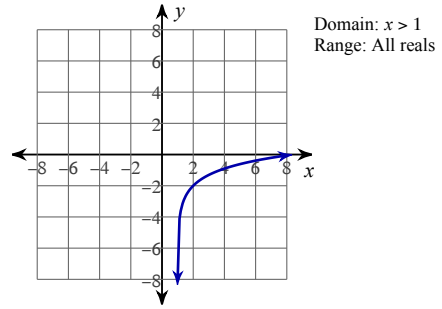


D)

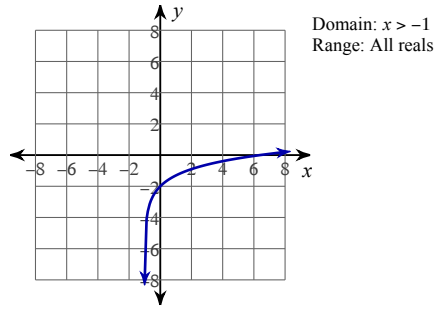


102) $y = \ln(x - 1) + 2$

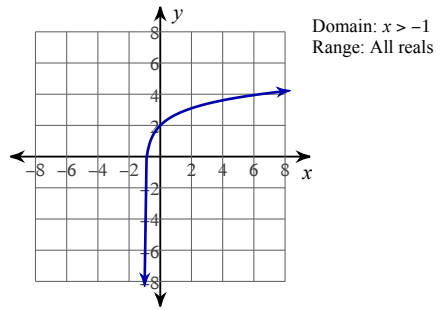
A)



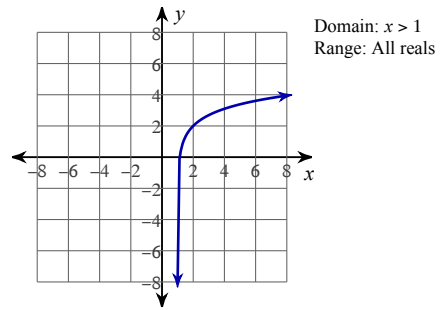
B)



C)

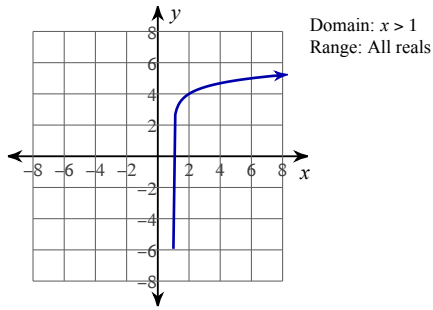


D)

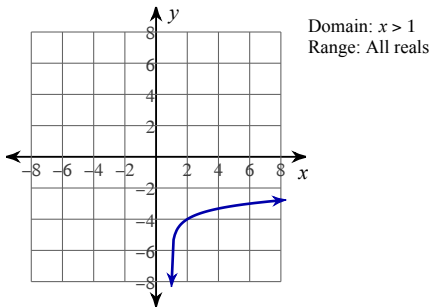


103) $y = \log_5(x + 1) + 4$

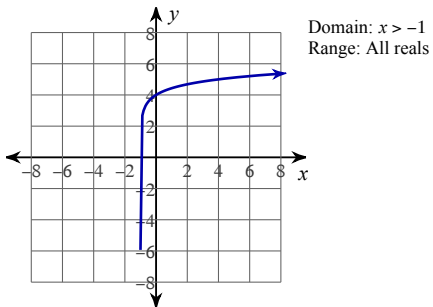
A)



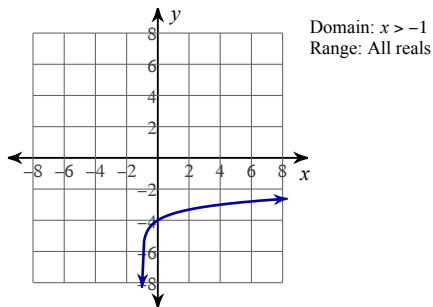
B)



C)

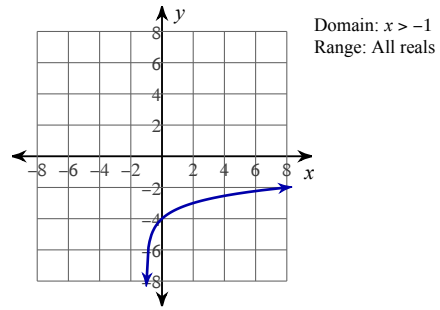


D)

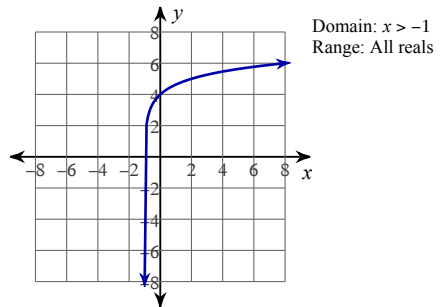


104) $y = \log_3(x - 1) + 4$

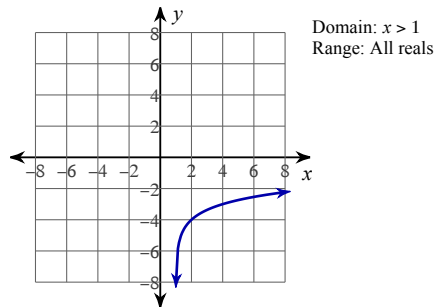
A)



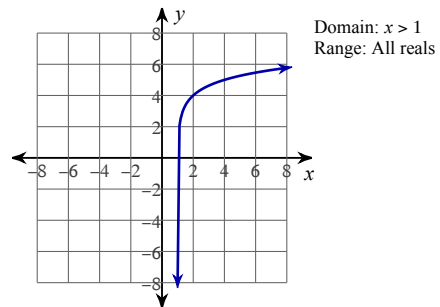
B)



C)

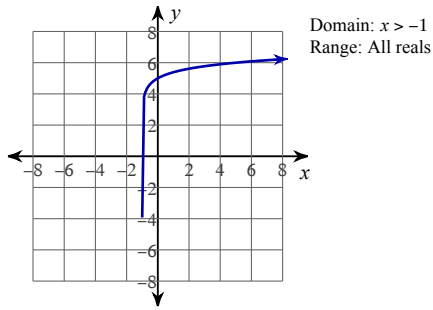


D)

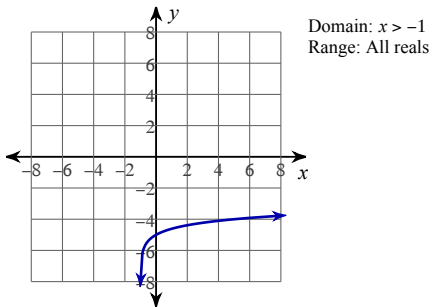


105) $y = \log_6(x - 1) + 5$

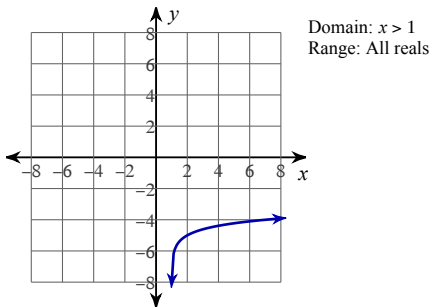
A)



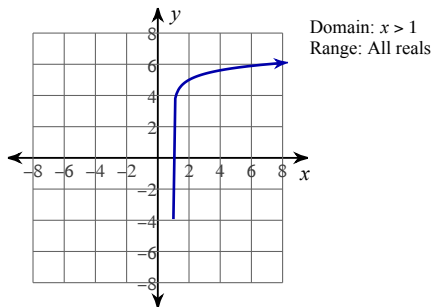
B)



C)

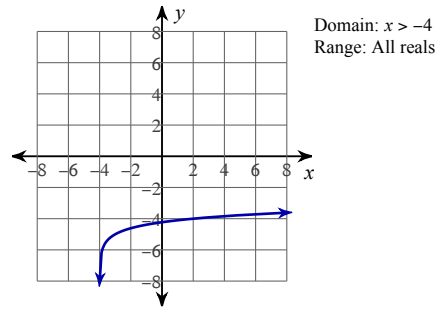


D)

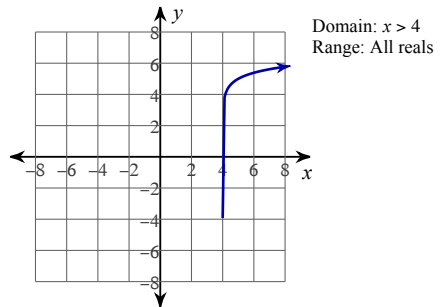


106) $y = \log_6(x + 4) - 5$

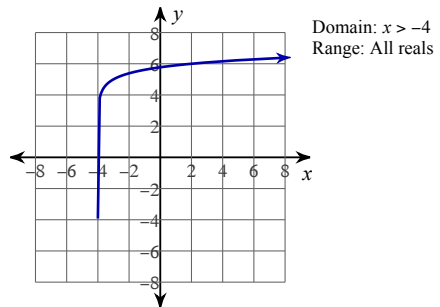
A)



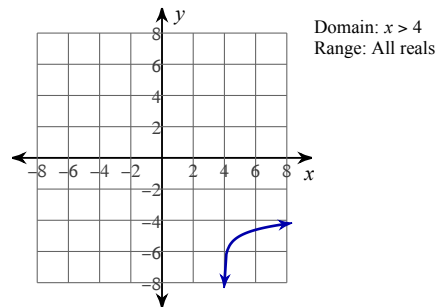
B)



C)

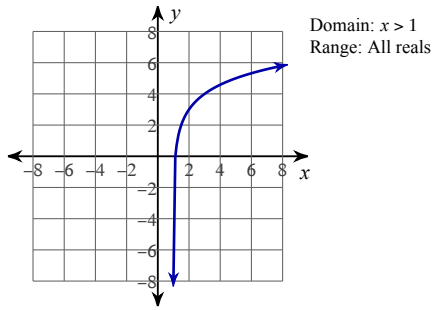


D)

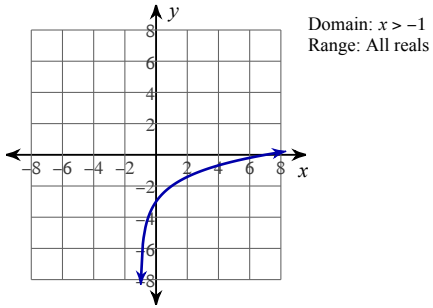


107) $y = \log_2(x - 1) - 3$

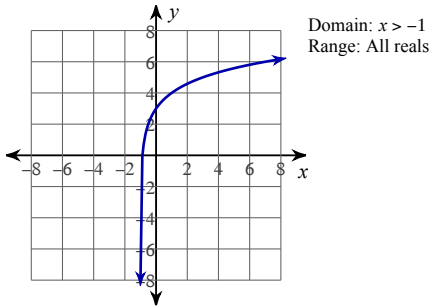
A)



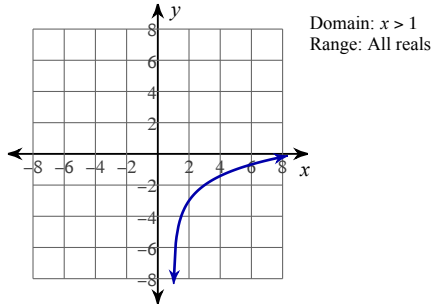
B)



C)

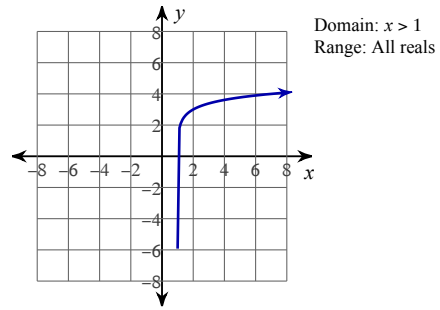


D)

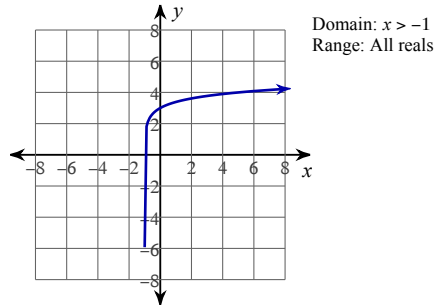


108) $y = \log_6(x - 1) + 3$

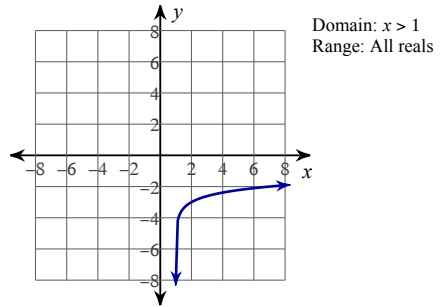
A)



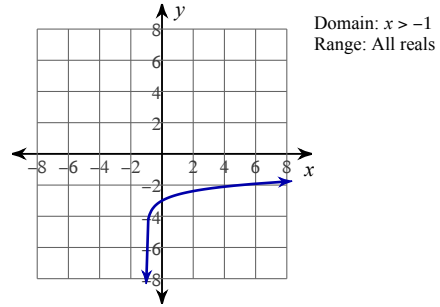
B)



C)

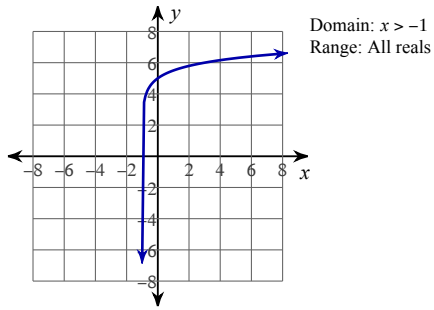


D)

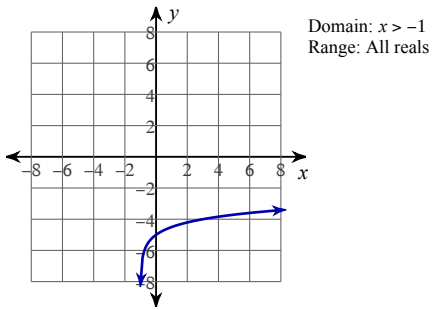


109) $y = \log_4(x - 1) + 5$

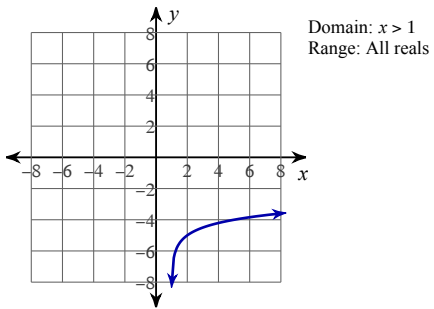
A)



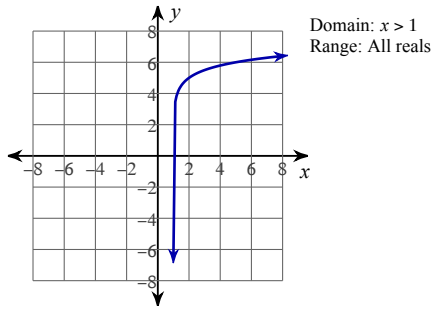
B)



C)

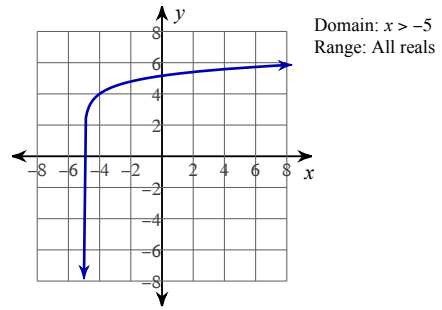


D)

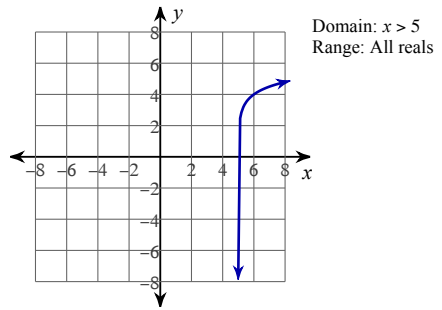


110) $y = \log_4(x + 5) + 4$

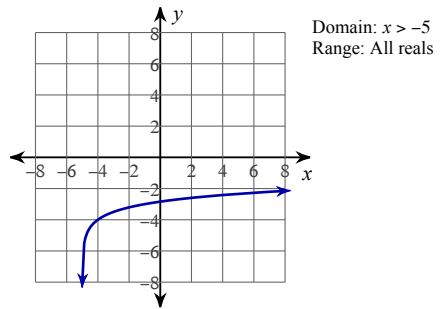
A)



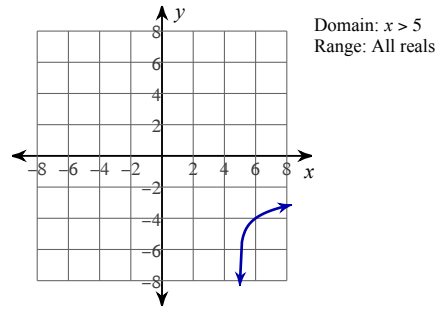
B)



C)

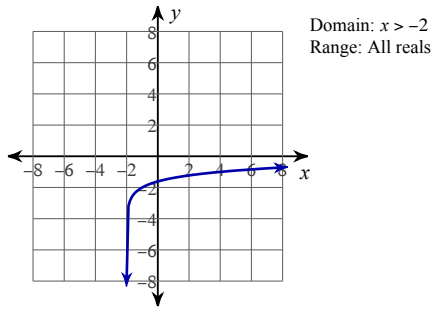


D)

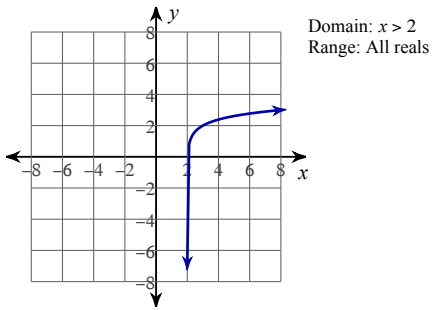


111) $y = \log_6(x + 2) - 2$

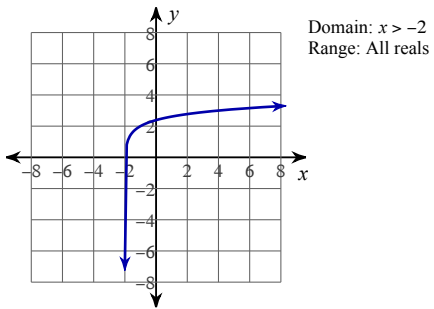
A)



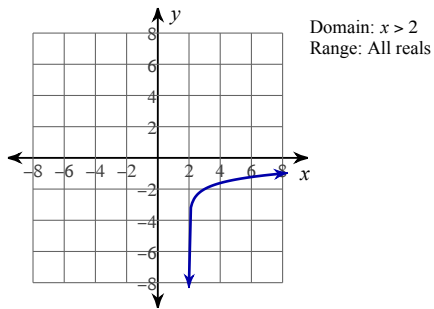
B)



C)

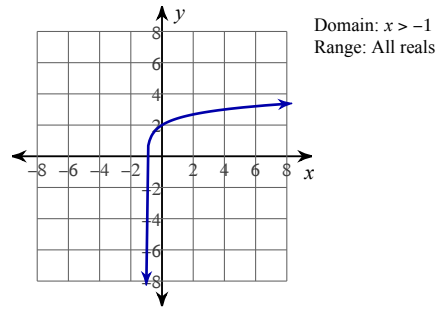


D)

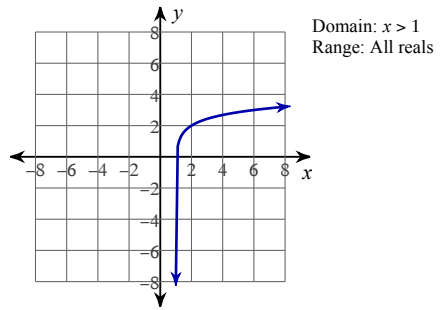


112) $y = \log_5(x - 1) + 2$

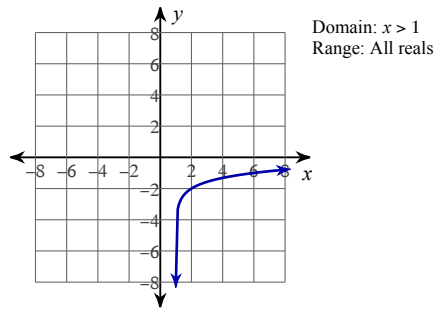
A)



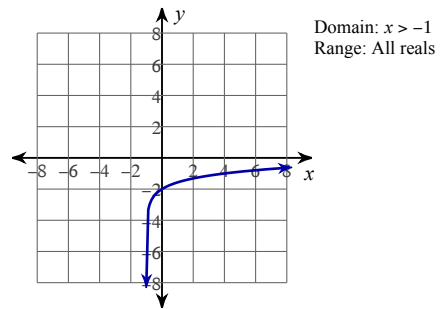
B)



C)

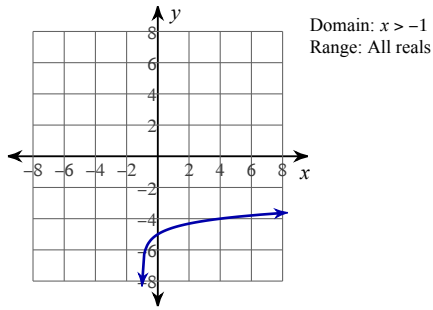


D)

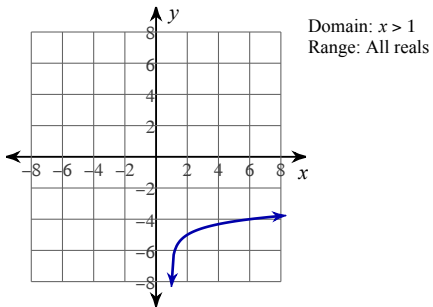


113) $y = \log_5(x - 1) + 5$

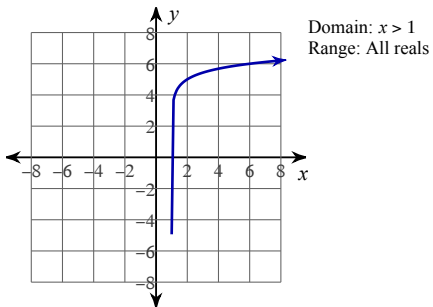
A)



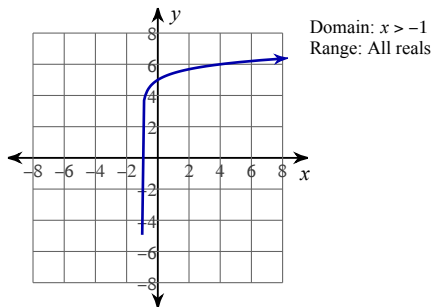
B)



C)

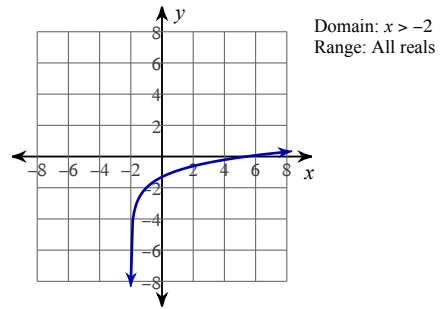


D)

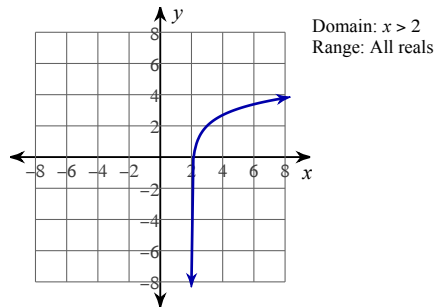


114) $y = \ln(x - 2) + 2$

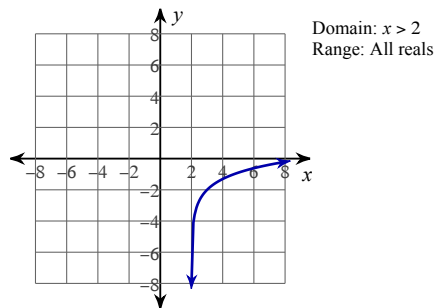
A)



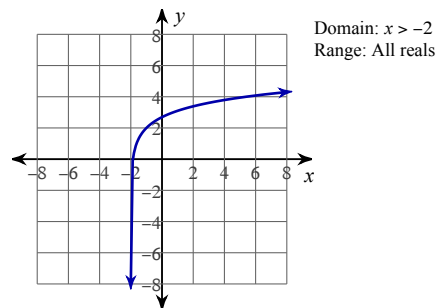
B)



C)

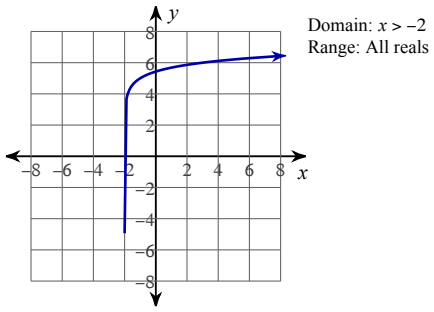


D)

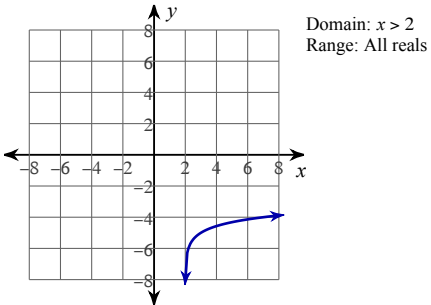


115) $y = \log_5(x - 2) + 5$

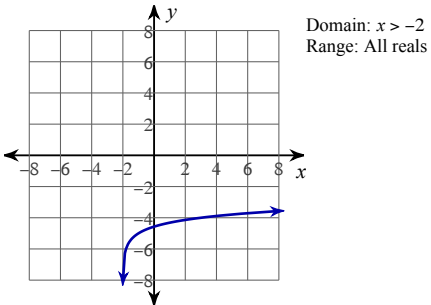
A)



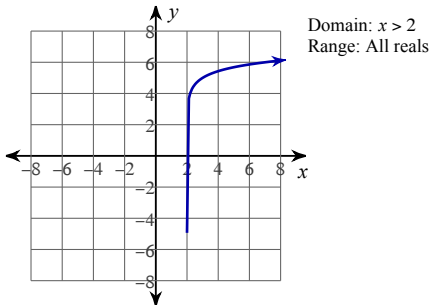
B)



C)

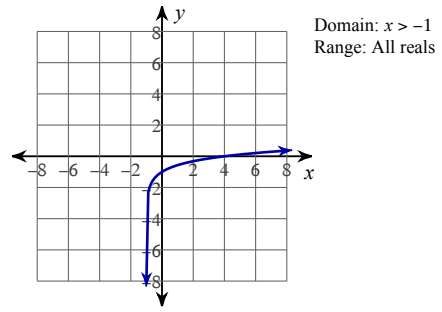


D)

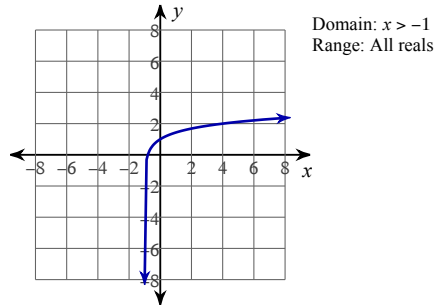


116) $y = \log_5(x - 1) + 1$

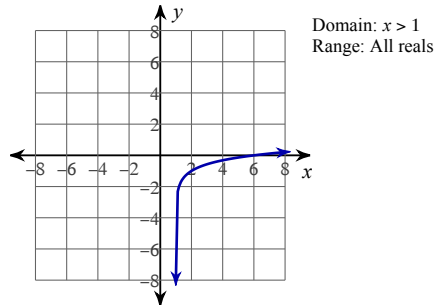
A)



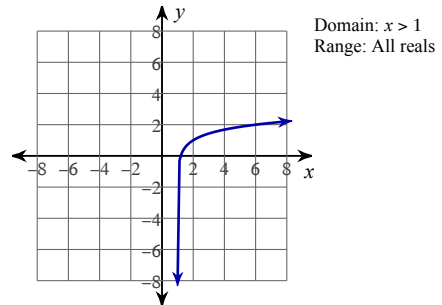
B)



C)

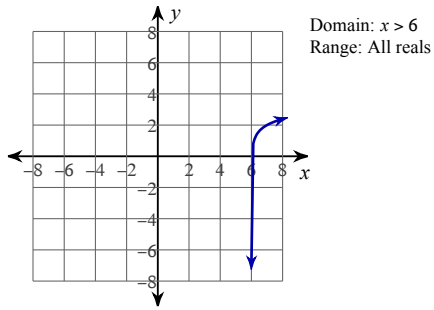


D)

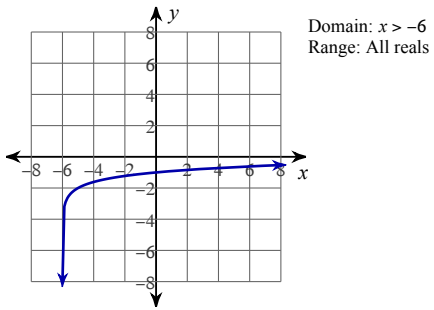


$$117) y = \log_6(x + 6) - 2$$

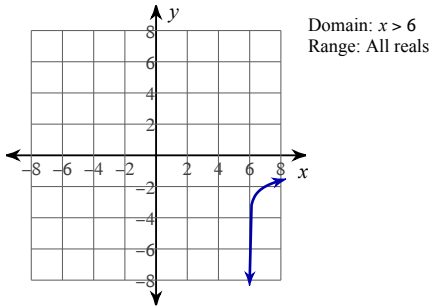
A)



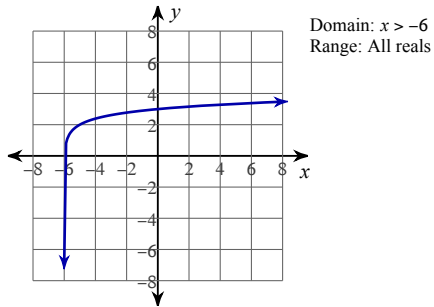
B)



C)

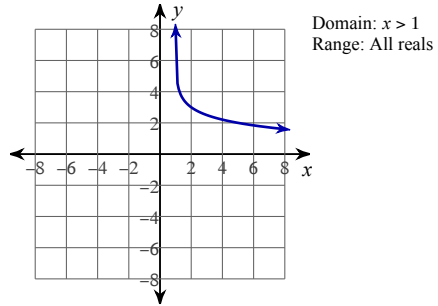


D)

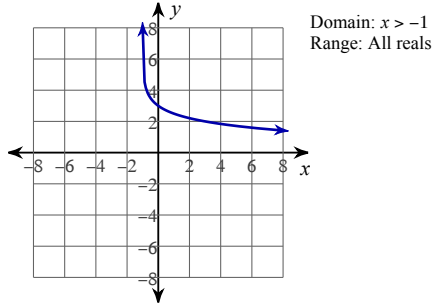


$$118) y = \log_{\frac{1}{4}}(x - 1) - 3$$

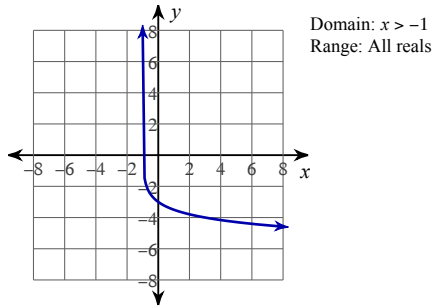
A)



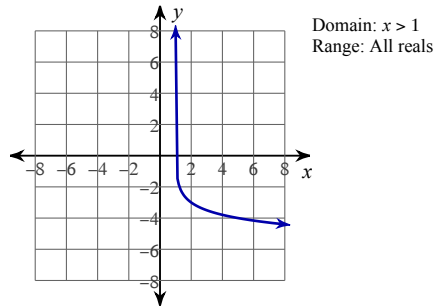
B)



C)

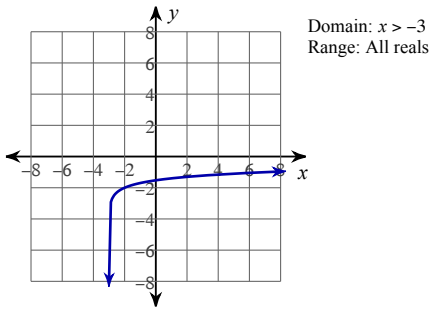


D)

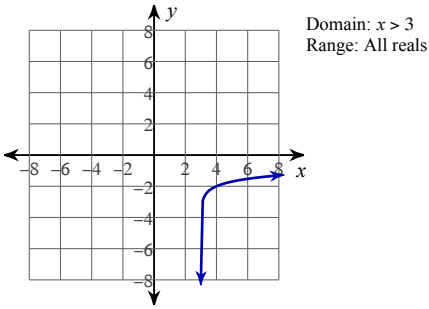


119) $y = \log(x + 3) - 2$

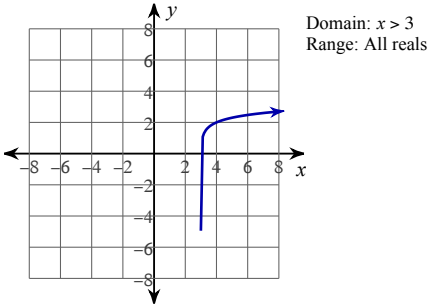
A)



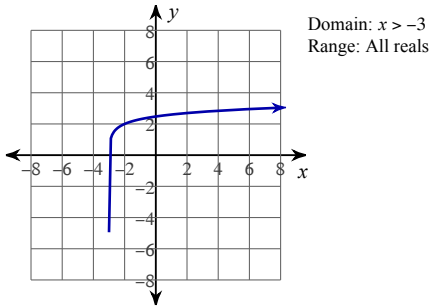
B)



C)

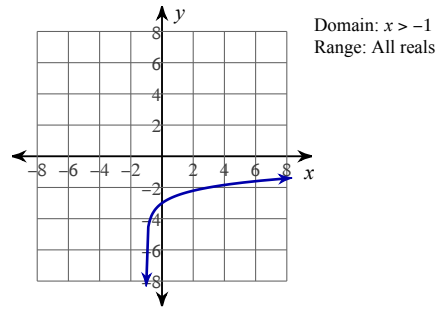


D)

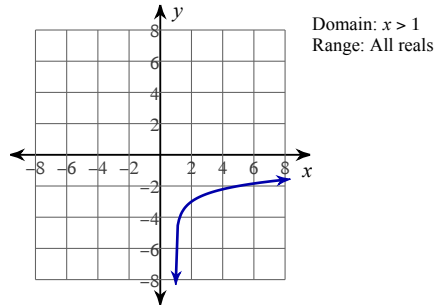


120) $y = \log_4(x - 1) + 3$

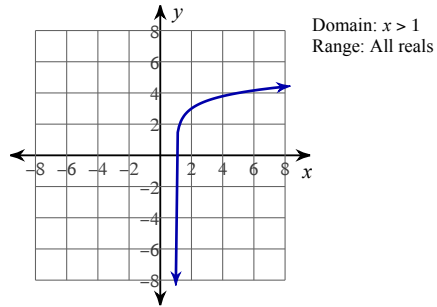
A)



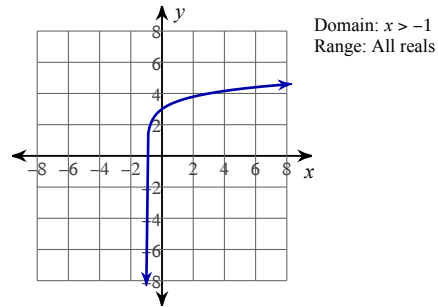
B)



C)



D)



Expand each logarithm.

121) $\log_4 \left(\frac{6^5}{11} \right)^2$

A) $10 \log_4 6 - 2 \log_4 11$

B) $5 \log_4 6 + 2 \log_4 11$

C) $\log_4 7 + \frac{\log_4 6}{2} + \frac{\log_4 11}{2}$

D) $10 \log_4 6 + 2 \log_4 11$

122) $\log_2 \sqrt[3]{5 \cdot 3 \cdot 8}$

A) $5 \log_2 5 + 5 \log_2 3$

B) $\frac{\log_2 5}{3} + \frac{\log_2 3}{3} + 1$

C) $15 + \frac{\log_2 5}{3}$

D) $5 \log_2 5 - 25 \log_2 3$

123) $\log_7 (2 \cdot 11 \cdot 5^2)$

- A) $3 \log_7 2 - 6 \log_7 11$
 B) $\log_7 2 + \log_7 11 + 2 \log_7 5$
 C) $2 \log_7 5 + \frac{\log_7 2}{3}$
 D) $2 \log_7 2 + 3 \log_7 11$

125) $\log_8 (3 \sqrt[3]{10 \cdot 11})$

- A) $8 \log_8 10 + 4 \log_8 11$
 B) $8 \log_8 10 - 4 \log_8 11$
 C) $2 \log_8 3 + \frac{\log_8 10}{3}$
 D) $\log_8 3 + \frac{\log_8 10}{3} + \frac{\log_8 11}{3}$

127) $\log_3 \left(\frac{a}{b^6} \right)^3$

- A) $3 \log_3 a - 18 \log_3 b$
 B) $18 \log_3 a + 3 \log_3 b$
 C) $\frac{\log_3 a}{2} + \frac{\log_3 b}{2} + \frac{\log_3 c}{2}$
 D) $3 \log_3 a + 18 \log_3 b$

129) $\log_9 (u \cdot v \cdot w^3)$

- A) $3 \log_9 u - 4 \log_9 v$
 B) $\frac{\log_9 u}{2} + \frac{\log_9 v}{2} + \frac{\log_9 w}{2}$
 C) $\log_9 u + \log_9 v + 3 \log_9 w$
 D) $\log_9 w + \frac{\log_9 u}{2} + \frac{\log_9 v}{2}$

131) $\log_9 (a^3 \cdot b)^6$

- A) $\log_9 a + \log_9 b + 3 \log_9 c$
 B) $3 \log_9 a - 6 \log_9 b$
 C) $18 \log_9 a - 6 \log_9 b$
 D) $18 \log_9 a + 6 \log_9 b$

124) $\log_5 (3^5 \sqrt{2})$

- A) $15 \log_5 2 - 3 \log_5 7$
 B) $5 \log_5 3 + \frac{\log_5 2}{2}$
 C) $15 \log_5 2 + 3 \log_5 7$
 D) $\frac{\log_5 2}{2} + \frac{\log_5 7}{2} + \frac{\log_5 3}{2}$

126) $\log_8 (10^6 \cdot 3)^2$

- A) $\log_8 11 + \frac{\log_8 10}{3} + \frac{\log_8 3}{3}$
 B) $\log_8 10 + \log_8 3 + 6 \log_8 11$
 C) $2 \log_8 10 - 12 \log_8 3$
 D) $12 \log_8 10 + 2 \log_8 3$

128) $\log_7 (u^5 \cdot v)^5$

- A) $\log_7 u + \log_7 v + 5 \log_7 w$
 B) $25 \log_7 u - 5 \log_7 v$
 C) $\log_7 w + \frac{\log_7 u}{3} + \frac{\log_7 v}{3}$
 D) $25 \log_7 u + 5 \log_7 v$

130) $\log_4 (c \sqrt[3]{a \cdot b})$

- A) $2 \log_4 a + 10 \log_4 b$
 B) $\log_4 c + \frac{\log_4 a}{3} + \frac{\log_4 b}{3}$
 C) $\frac{\log_4 a}{3} + \frac{\log_4 b}{3} + \frac{\log_4 c}{3}$
 D) $\log_4 a + \log_4 b + 5 \log_4 c$

132) $\log_5 \sqrt{u \cdot v \cdot w}$

- A) $\frac{\log_5 u}{2} + \frac{\log_5 v}{2} + \frac{\log_5 w}{2}$
 B) $\log_5 u + \log_5 v + 3 \log_5 w$
 C) $3 \log_5 u - 2 \log_5 v$
 D) $3 \log_5 w + \frac{\log_5 u}{2}$

$$133) \log_3 \sqrt[3]{11 \cdot 10 \cdot 7}$$

$$A) 2\log_3 7 + \frac{\log_3 11}{3}$$

$$B) \log_3 11 + \log_3 10 + 2\log_3 7$$

$$C) 2\log_3 11 + 4\log_3 10$$

$$D) \frac{\log_3 11}{3} + \frac{\log_3 10}{3} + \frac{\log_3 7}{3}$$

$$135) \log_2 (x^3 \cdot y)^3$$

$$A) 9\log_2 x + 3\log_2 y$$

$$B) \log_2 x + \log_2 y + 3\log_2 z$$

$$C) \log_2 z + \frac{\log_2 x}{3} + \frac{\log_2 y}{3}$$

$$D) 3\log_2 x + 9\log_2 y$$

$$137) \log_6 \left(\frac{u}{v^6} \right)^2$$

$$A) 6\log_6 u - 2\log_6 v$$

$$B) 6\log_6 u + 2\log_6 v$$

$$C) \log_6 w + \frac{\log_6 u}{2} + \frac{\log_6 v}{2}$$

$$D) 2\log_6 u - 12\log_6 v$$

$$139) \log_5 (7^4 \sqrt[3]{10})$$

$$A) \frac{\log_5 10}{3} + \frac{\log_5 11}{3} + \frac{\log_5 7}{3}$$

$$B) 12\log_5 10 + 3\log_5 11$$

$$C) 4\log_5 7 + \frac{\log_5 10}{3}$$

$$D) 3\log_5 10 + 12\log_5 11$$

$$141) \log_8 (a^4 \cdot b)^2$$

$$A) \log_8 a + \log_8 b + 4\log_8 c$$

$$B) 8\log_8 a + 2\log_8 b$$

$$C) 2\log_8 a - 8\log_8 b$$

$$D) \frac{\log_8 a}{2} + \frac{\log_8 b}{2} + \frac{\log_8 c}{2}$$

$$134) \log_6 (x^6 \cdot y)^2$$

$$A) 12\log_6 x + 2\log_6 y$$

$$B) \frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$$

$$C) 2\log_6 x - 12\log_6 y$$

$$D) 6\log_6 x - 2\log_6 y$$

$$136) \log_7 (5 \sqrt[3]{3 \cdot 8})$$

$$A) \log_7 5 + \frac{\log_7 3}{3} + \frac{\log_7 8}{3}$$

$$B) 6\log_7 3 + 24\log_7 8$$

$$C) 4\log_7 5 + \frac{\log_7 3}{3}$$

$$D) 24\log_7 3 - 6\log_7 8$$

$$138) \log_9 (5^6 \cdot 7)^5$$

$$A) 30\log_9 5 + 5\log_9 7$$

$$B) 5\log_9 5 + 30\log_9 7$$

$$C) \frac{\log_9 5}{2} + \frac{\log_9 7}{2} + \frac{\log_9 8}{2}$$

$$D) 5\log_9 5 - 30\log_9 7$$

$$140) \log_8 \sqrt[3]{2 \cdot 7 \cdot 5}$$

$$A) \log_8 2 + \log_8 7 + 6\log_8 5$$

$$B) \log_8 5 + \frac{\log_8 2}{3} + \frac{\log_8 7}{3}$$

$$C) \frac{\log_8 2}{3} + \frac{\log_8 7}{3} + \frac{\log_8 5}{3}$$

$$D) 6\log_8 2 + 6\log_8 7$$

$$142) \log_7 (8 \cdot 5^4)^3$$

$$A) 3\log_7 8 + 12\log_7 5$$

$$B) 4\log_7 8 - 3\log_7 5$$

$$C) \log_7 11 + \frac{\log_7 8}{3} + \frac{\log_7 5}{3}$$

$$D) 4\log_7 11 + \frac{\log_7 8}{3}$$

$$143) \log_7 \frac{u^2}{v^5}$$

- A) $2\log_7 u - 5\log_7 v$
- B) $\log_7 u + \log_7 v + 2\log_7 w$
- C) $5\log_7 u + 10\log_7 v$
- D) $10\log_7 u + 5\log_7 v$

$$145) \log_4 (x^3 \cdot y)^6$$

- A) $3\log_4 x - 6\log_4 y$
- B) $\log_4 z + \frac{\log_4 x}{2} + \frac{\log_4 y}{2}$
- C) $\frac{\log_4 x}{2} + \frac{\log_4 y}{2} + \frac{\log_4 z}{2}$
- D) $18\log_4 x + 6\log_4 y$

$$147) \log_2 \frac{x^6}{y^4}$$

- A) $4\log_2 x + 24\log_2 y$
- B) $\frac{\log_2 x}{3} + \frac{\log_2 y}{3} + \frac{\log_2 z}{3}$
- C) $4\log_2 x - 24\log_2 y$
- D) $6\log_2 x - 4\log_2 y$

$$149) \log_6 (x \cdot y \cdot z^4)$$

- A) $\log_6 x + \log_6 y + 4\log_6 z$
- B) $4\log_6 x - 4\log_6 y$
- C) $\frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$
- D) $4\log_6 z + \frac{\log_6 x}{3}$

$$151) \log_9 \left(\frac{x^6}{y}\right)^2$$

- A) $2\log_9 x - 12\log_9 y$
- B) $12\log_9 x - 2\log_9 y$
- C) $2\log_9 x + 12\log_9 y$
- D) $\frac{\log_9 x}{2} + \frac{\log_9 y}{2} + \frac{\log_9 z}{2}$

$$144) \log_5 \sqrt{6 \cdot 7 \cdot 11}$$

- A) $15\log_5 6 + 3\log_5 7$
- B) $5\log_5 11 + \frac{\log_5 6}{2}$
- C) $3\log_5 6 + 15\log_5 7$
- D) $\frac{\log_5 6}{2} + \frac{\log_5 7}{2} + \frac{\log_5 11}{2}$

$$146) \log_8 \sqrt{x \cdot y \cdot z}$$

- A) $\frac{\log_8 x}{2} + \frac{\log_8 y}{2} + \frac{\log_8 z}{2}$
- B) $\log_8 z + \frac{\log_8 x}{2} + \frac{\log_8 y}{2}$
- C) $\log_8 x + \log_8 y + 2\log_8 z$
- D) $2\log_8 z + \frac{\log_8 x}{2}$

$$148) \log_7 \frac{3^4}{10^6}$$

- A) $4\log_7 3 + 6\log_7 10$
- B) $\log_7 3 + \log_7 10 + 4\log_7 11$
- C) $6\log_7 3 - 24\log_7 10$
- D) $4\log_7 3 - 6\log_7 10$

$$150) \log_6 \left(\frac{3}{8^5}\right)^4$$

- A) $5\log_6 3 + 4\log_6 8$
- B) $5\log_6 5 + \frac{\log_6 3}{2}$
- C) $4\log_6 3 - 20\log_6 8$
- D) $20\log_6 3 + 4\log_6 8$

$$152) \log_2 \left(\frac{8}{5^6}\right)^5$$

- A) $18 + 5\log_2 5$
- B) $6\log_2 11 + 1$
- C) $15 - 30\log_2 5$
- D) $90 - 5\log_2 5$

$$153) \log_4 \left(\frac{x}{y^5} \right)^4$$

- A) $20 \log_4 x + 4 \log_4 y$
- B) $4 \log_4 x - 20 \log_4 y$
- C) $5 \log_4 x + 4 \log_4 y$
- D) $\log_4 z + \frac{\log_4 x}{3} + \frac{\log_4 y}{3}$

$$155) \log_5 \sqrt{10 \cdot 3 \cdot 7}$$

- A) $4 \log_5 10 + 4 \log_5 3$
- B) $\frac{\log_5 10}{2} + \frac{\log_5 3}{2} + \frac{\log_5 7}{2}$
- C) $\log_5 7 + \frac{\log_5 10}{2} + \frac{\log_5 3}{2}$
- D) $16 \log_5 10 - 4 \log_5 3$

$$157) \log_5 (11^3 \sqrt{3})$$

- A) $3 \log_5 3 - 2 \log_5 7$
- B) $3 \log_5 11 + \frac{\log_5 3}{2}$
- C) $\frac{\log_5 3}{2} + \frac{\log_5 7}{2} + \frac{\log_5 11}{2}$
- D) $2 \log_5 3 - 6 \log_5 7$

$$159) \log_9 (a^5 b^5)$$

- A) $5 \log_9 a + 5 \log_9 b$
- B) $25 \log_9 a - 5 \log_9 b$
- C) $\frac{\log_9 a}{3} + \frac{\log_9 b}{3} + \frac{\log_9 c}{3}$
- D) $5 \log_9 a - 5 \log_9 b$

Condense each expression to a single logarithm.

$$161) 8 \log_4 u - 4 \log_4 v$$

- A) $\log_4 \frac{u^8}{v^4}$
- B) $\log_4 (vuw^2)$
- C) $\log_4 \sqrt[3]{wvu}$
- D) $\log_4 (v^4 u^2)$

$$154) \log_4 (2^6 \cdot 7)^2$$

- A) $6 \log_4 2 - 2 \log_4 7$
- B) $12 \log_4 2 + 2 \log_4 7$
- C) $6 \log_4 2 + 2 \log_4 7$
- D) $\frac{\log_4 2}{3} + \frac{\log_4 7}{3} + \frac{\log_4 11}{3}$

$$156) \log_9 (x^3 \cdot y)^4$$

- A) $12 \log_9 x + 4 \log_9 y$
- B) $3 \log_9 z + \frac{\log_9 x}{2}$
- C) $3 \log_9 x + 4 \log_9 y$
- D) $\frac{\log_9 x}{2} + \frac{\log_9 y}{2} + \frac{\log_9 z}{2}$

$$158) \log_6 \left(\frac{a^3}{b} \right)^4$$

- A) $12 \log_6 a - 4 \log_6 b$
- B) $\log_6 c + \frac{\log_6 a}{2} + \frac{\log_6 b}{2}$
- C) $3 \log_6 a - 4 \log_6 b$
- D) $\frac{\log_6 a}{2} + \frac{\log_6 b}{2} + \frac{\log_6 c}{2}$

$$160) \log_7 (ab^3)^5$$

- A) $5 \log_7 a + 15 \log_7 b$
- B) $3 \log_7 c + \frac{\log_7 a}{2}$
- C) $3 \log_7 a + 5 \log_7 b$
- D) $15 \log_7 a + 5 \log_7 b$

$$162) 10 \log_6 x + 5 \log_6 y$$

- A) $\log_6 (y^5 x^{10})$
- B) $\log_6 \frac{x^5}{y^{10}}$
- C) $\log_6 (z^2 \sqrt{x})$
- D) $\log_6 (yxz^2)$

163) $4\log_9 3 + 5\log_9 2$

- A) $\log_9 (2^{20} \cdot 3^5)$
- B) $\log_9 \frac{3^4}{2^5}$
- C) $\log_9 (2^5 \cdot 3^4)$
- D) $\log_9 (11\sqrt[3]{6})$

165) $4\log_6 u + 8\log_6 v$

- A) $\log_6 (w^2\sqrt{u})$
- B) $\log_6 (v^8u^4)$
- C) $\log_6 (vuw^2)$
- D) $\log_6 \frac{u^2}{v^4}$

167) $20\log_7 3 - 4\log_7 2$

- A) $\log_7 \frac{3^{20}}{2^4}$
- B) $\log_7 (2^{20} \cdot 3^4)$
- C) $\log_7 \frac{3^5}{2^4}$
- D) $\log_7 \sqrt[3]{30}$

169) $6\log_3 12 - 3\log_3 7$

- A) $\log_3 (84 \cdot 11^6)$
- B) $\log_3 \frac{12^6}{7^3}$
- C) $\log_3 \frac{12^3}{7^{18}}$
- D) $\log_3 \sqrt[3]{924}$

171) $\log_3 x + \log_3 y + 5\log_3 z$

- A) $\log_3 (yxz^5)$
- B) $\log_3 \frac{x^5}{y^{25}}$
- C) $\log_3 (y^{25}x^5)$
- D) $\log_3 (y^5x^{25})$

164) $4\log_2 10 - 2\log_2 7$

- A) $\log_2 (7^8 \cdot 10^2)$
- B) $\log_2 (3^4\sqrt[3]{10})$
- C) $\log_2 (70 \cdot 3^4)$
- D) $\log_2 \frac{10^4}{7^2}$

166) $\frac{\log_2 7}{3} + \frac{\log_2 3}{3} + \frac{\log_2 5}{3}$

- A) $\log_2 (5^2\sqrt[3]{7})$
- B) $\log_2 \sqrt[3]{105}$
- C) $\log_2 (3^3 \cdot 7^6)$
- D) $\log_2 \frac{7^2}{3^3}$

168) $\log_4 z + \frac{\log_4 x}{2} + \frac{\log_4 y}{2}$

- A) $\log_4 (y^6x^3)$
- B) $\log_4 (z\sqrt{yx})$
- C) $\log_4 (y^3x^2)$
- D) $\log_4 \frac{x^6}{y^3}$

170) $\log_6 z + \frac{\log_6 x}{3} + \frac{\log_6 y}{3}$

- A) $\log_6 \frac{x^6}{y^{24}}$
- B) $\log_6 (yxz^4)$
- C) $\log_6 (z\sqrt[3]{yx})$
- D) $\log_6 (y^6x^{24})$

172) $\log_6 x + \log_6 y + 3\log_6 z$

- A) $\log_6 (z^3\sqrt[3]{x})$
- B) $\log_6 \frac{x^3}{y^6}$
- C) $\log_6 (yxz^3)$
- D) $\log_6 (y^{18}x^6)$

173) $\ln x + \ln y + 3 \ln z$

- A) $\ln (y^6 x^2)$ B) $\ln \frac{x^3}{y^2}$
 C) $\ln (yxz^3)$ D) $\ln \sqrt[3]{zyx}$

175) $6 \log_2 6 + 12 \log_2 5$

- A) $\log_2 (5^6 \cdot 6^{12})$
 B) $\log_2 (5^6 \cdot 6^2)$
 C) $\log_2 (7^2 \sqrt{6})$
 D) $\log_2 (5^{12} \cdot 6^6)$

177) $\log_7 x + \log_7 y + 2 \log_7 z$

- A) $\log_7 (yxz^2)$ B) $\log_7 \sqrt{zyx}$
 C) $\log_7 (y^8 x^4)$ D) $\log_7 (y^4 x^2)$

179) $2 \log_7 x - 2 \log_7 y$

- A) $\log_7 (yxz^2)$ B) $\log_7 \frac{x^4}{y^2}$
 C) $\log_7 \frac{x^2}{y^2}$ D) $\log_7 (y^4 x^2)$

181) $2 \log_4 x + 10 \log_4 y$

- A) $\log_4 (y^2 x^5)$ B) $\log_4 (y^{10} x^2)$
 C) $\log_4 \frac{x^{10}}{y^2}$ D) $\log_4 (y^2 x^{10})$

174) $5 \log_4 a + 20 \log_4 b$

- A) $\log_4 \frac{a^5}{b^{20}}$ B) $\log_4 (b^5 a^4)$
 C) $\log_4 \frac{a^{20}}{b^5}$ D) $\log_4 (b^{20} a^5)$

176) $12 \log_8 x - 3 \log_8 y$

- A) $\log_8 (z \sqrt{yx})$ B) $\log_8 \frac{x^{12}}{y^3}$
 C) $\log_8 (yxz^4)$ D) $\log_8 \frac{x^3}{y^{12}}$

178) $\frac{\log_5 3}{2} + \frac{\log_5 10}{2} + \frac{\log_5 7}{2}$

- A) $\log_5 \sqrt{210}$
 B) $\log_5 (7 \sqrt{30})$
 C) $\log_5 \frac{3^3}{10^2}$
 D) $\log_5 (10^6 \cdot 3^2)$

180) $\log_9 x + \log_9 y + 6 \log_9 z$

- A) $\log_9 (yxz^6)$
 B) $\log_9 (y^2 x^{12})$
 C) $\log_9 (z^6 \sqrt[3]{x})$
 D) $\log_9 \frac{x^{12}}{y^2}$

182) $3 \log_6 x - 9 \log_6 y$

- A) $\log_6 (z \sqrt[3]{yx})$
 B) $\log_6 \frac{x^3}{y^3}$
 C) $\log_6 \frac{x^3}{y^9}$
 D) $\log_6 (yxz^3)$

183) $4 \log_5 a - 8 \log_5 b$

A) $\log_5 (c\sqrt{ba})$

B) $\log_5 (bac^2)$

C) $\log_5 \frac{a^4}{b^8}$

D) $\log_5 (b^4 a^8)$

185) $3 \log_5 7 + 3 \log_5 10$

A) $\log_5 (10^3 \cdot 7^3)$

B) $\log_5 (3^3 \sqrt[3]{7})$

C) $\log_5 (10^3 \cdot 7^9)$

D) $\log_5 (10^9 \cdot 7^3)$

187) $5 \log_2 11 + \frac{\log_2 3}{2}$

A) $\log_2 (11^5 \sqrt{3})$

B) $\log_2 \sqrt{330}$

C) $\log_2 (11 \sqrt{30})$

D) $\log_2 \frac{3^{15}}{10^3}$

189) $5 \log_2 x + 20 \log_2 y$

A) $\log_2 (y^{20} x^5)$

B) $\log_2 (y^5 x^4)$

C) $\log_2 (y^5 x^{20})$

D) $\log_2 \frac{x^5}{y^{20}}$

191) $\log_6 x + \log_6 y + 6 \log_6 z$

A) $\log_6 (yxz^6)$

B) $\log_6 \frac{x^5}{y^{30}}$

C) $\log_6 (z \sqrt[3]{yx})$

D) $\log_6 (y^{30} x^5)$

184) $16 \ln x - 4 \ln y$

A) $\ln (y^4 x^4)$

B) $\ln \sqrt[3]{zyx}$

C) $\ln \frac{x^{16}}{y^4}$

D) $\ln (z^4 \sqrt[3]{x})$

186) $3 \log_7 w + \frac{\log_7 u}{3}$

A) $\log_7 (v^4 u^3)$

B) $\log_7 \sqrt[3]{wvu}$

C) $\log_7 (w^3 \sqrt[3]{u})$

D) $\log_7 \frac{u^3}{v^4}$

188) $4 \log_8 w + \frac{\log_8 u}{3}$

A) $\log_8 \frac{u^{16}}{v^4}$

B) $\log_8 (w^4 \sqrt[3]{u})$

C) $\log_8 (v^4 u^{16})$

D) $\log_8 (v^{16} u^4)$

190) $2 \log_6 a - 8 \log_6 b$

A) $\log_6 (bac^4)$

B) $\log_6 (b^8 a^2)$

C) $\log_6 \frac{a^2}{b^8}$

D) $\log_6 \sqrt[3]{cba}$

192) $2 \log_7 5 + 4 \log_7 8$

A) $\log_7 \sqrt{120}$

B) $\log_7 (8^4 \cdot 5^2)$

C) $\log_7 \frac{5^2}{8^4}$

D) $\log_7 \frac{5^4}{8^2}$

$$193) \frac{\log_2 x}{3} + \frac{\log_2 y}{3} + \frac{\log_2 z}{3}$$

- A) $\log_2 \frac{x^9}{y^3}$
- B) $\log_2 \sqrt[3]{zyx}$
- C) $\log_2 (y^9 x^3)$
- D) $\log_2 (z^3 \sqrt[3]{x})$

$$195) \frac{\log_2 x}{2} + \frac{\log_2 y}{2} + \frac{\log_2 z}{2}$$

- A) $\log_2 (z \sqrt{yx})$
- B) $\log_2 \frac{x^6}{y^{18}}$
- C) $\log_2 (z^3 \sqrt{x})$
- D) $\log_2 \sqrt{zyx}$

$$197) 3 \log_2 a + 15 \log_2 b$$

- A) $\log_2 (c \sqrt[3]{ba})$
- B) $\log_2 (c^5 \sqrt[3]{a})$
- C) $\log_2 \frac{a^3}{b^{15}}$
- D) $\log_2 (b^{15} a^3)$

$$199) 6 \ln 7 - 24 \ln 11$$

- A) $\ln \frac{7^6}{11^{24}}$
- B) $\ln (8^4 \sqrt{7})$
- C) $\ln (11^6 \cdot 7^4)$
- D) $\ln (8 \sqrt{77})$

$$194) \frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$$

- A) $\log_6 (z \sqrt[3]{yx})$
- B) $\log_6 \frac{x^3}{y^9}$
- C) $\log_6 (y^3 x^9)$
- D) $\log_6 \sqrt[3]{zyx}$

$$196) 18 \log_4 x - 3 \log_4 y$$

- A) $\log_4 \frac{x^6}{y^3}$
- B) $\log_4 \frac{x^{18}}{y^3}$
- C) $\log_4 (z^6 \sqrt{x})$
- D) $\log_4 (y^3 x^6)$

$$198) \frac{\log_4 x}{3} + \frac{\log_4 y}{3} + \frac{\log_4 z}{3}$$

- A) $\log_4 \frac{x^9}{y^3}$
- B) $\log_4 (z \sqrt[3]{yx})$
- C) $\log_4 \sqrt[3]{zyx}$
- D) $\log_4 (y^9 x^3)$

$$200) 12 \log_4 x + 6 \log_4 y$$

- A) $\log_4 (y^6 x^{12})$
- B) $\log_4 (z^2 \sqrt{x})$
- C) $\log_4 (y^6 x^2)$
- D) $\log_4 (y^{12} x^6)$

Assignment

Date _____ Period _____

Evaluate each expression.

1) $\log_7 \frac{1}{343}$

-3

3) $\log_2 1$

0

5) $\log_3 \frac{1}{27}$

-3

7) $\log_2 \frac{1}{64}$

-6

9) $\log_2 16$

4

11) $\log_4 64$

3

13) $\log_6 6$

1

15) $\log_3 1$

0

17) $\log_3 \frac{1}{9}$

-2

19) $\log_2 4$

2

21) $\log_5 \frac{1}{125}$

-3

23) $\log_6 216$

3

2) $\log_4 \frac{1}{16}$

-2

4) $\log_2 64$

6

6) $\log_7 1$

0

8) $\log_3 81$

4

10) $\log_3 243$

5

12) $\log_7 \frac{1}{49}$

-2

14) $\log_2 32$

5

16) $\log_2 \frac{1}{16}$

-4

18) $\log_7 49$

2

20) $\log_4 4$

1

22) $\log_2 \frac{1}{8}$

-3

24) $\log_3 \frac{1}{243}$

-5

25) $\log_4 \frac{1}{4}$

-1

27) $\log_5 \frac{1}{25}$

-2

29) $\log_4 \frac{1}{64}$

-3

31) $\log_4 1$

0

33) $\log_5 25$

2

35) $\log_6 36$

2

37) $\log_6 1$

0

39) $\log_3 9$

2

26) $\log_7 343$

3

28) $\log_6 \frac{1}{36}$

-2

30) $\log_2 8$

3

32) $\log_2 \frac{1}{4}$

-2

34) $\log_4 16$

2

36) $\log_6 \frac{1}{216}$

-3

38) $\log_5 125$

3

40) $\log_3 27$

3

Use a calculator to approximate each to the nearest thousandth.

41) $\log_5 43$

2.337

43) $\log_4 4.8$

1.132

45) $\log_2 58$

5.858

47) $\log_2 18$

4.17

49) $\log_2 30$

4.907

51) $\log_2 17$

4.087

53) $\log_5 5.6$

1.07

42) $\ln 6$

1.792

44) $\log_6 3.3$

0.666

46) $\log_4 1.7$

0.383

48) $\log_2 5$

2.322

50) $\log_2 69$

6.109

52) $\log_3 3.23$

1.067

54) $\log 17$

1.23

$55) \log_7 58$

2.087

$57) \log_6 26$

1.818

$59) \log_7 4.6$

0.784

$61) \log_6 69$

2.363

$63) \log_7 1.2$

0.094

$65) \log_4 2.2$

0.569

$67) \log 3$

0.477

$69) \ln 4$

1.386

$71) \log_2 16$

4

$73) \log_2 12$

3.585

$75) \log_7 31$

1.765

$77) \log_3 1.9$

0.584

$79) \log_5 3.6$

0.796

$56) \log_5 61$

2.554

$58) \log_7 21$

1.565

$60) \log_2 54$

5.755

$62) \log 5.3$

0.724

$64) \log_7 5.3$

0.857

$66) \log_4 2.3$

0.601

$68) \log_2 25$

4.644

$70) \log_4 39$

2.643

$72) \log_3 6$

1.631

$74) \log_3 1.7$

0.483

$76) \log_5 29$

2.092

$78) \log_6 6.9$

1.078

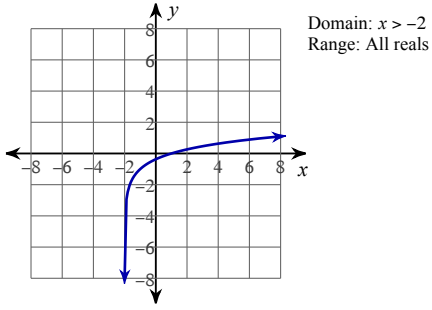
$80) \log_3 2.8$

0.937

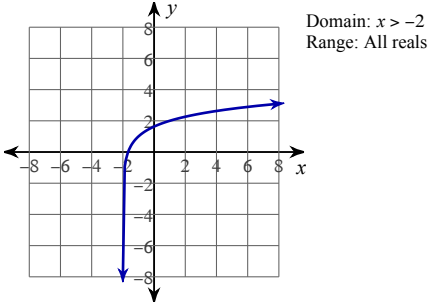
Identify the domain and range of each. Then sketch the graph.

81) $y = \log_3(x + 2) + 1$

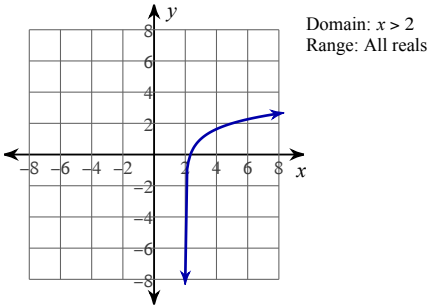
A)



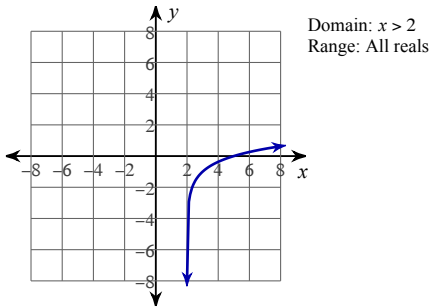
*B)



C)

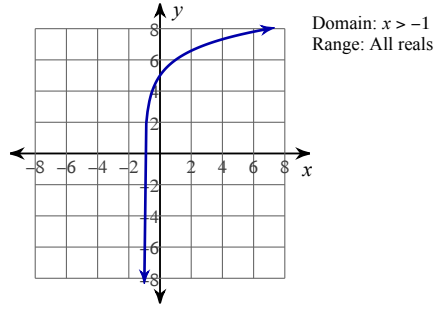


D)

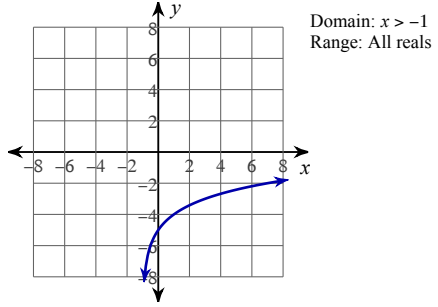


82) $y = \log_2(x - 1) - 5$

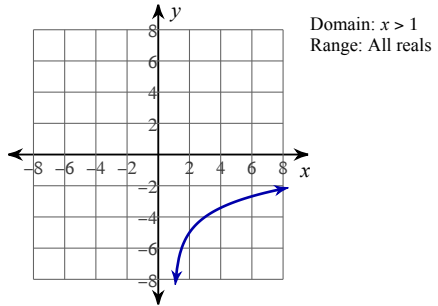
A)



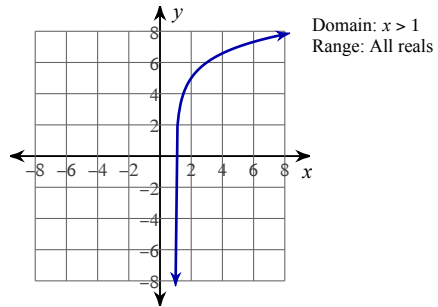
B)



*C)

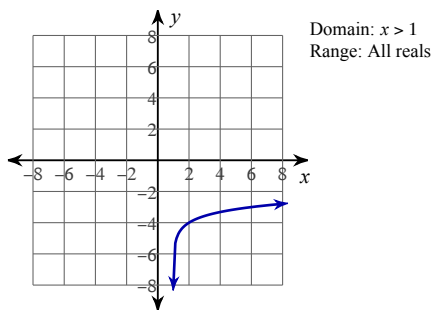


D)

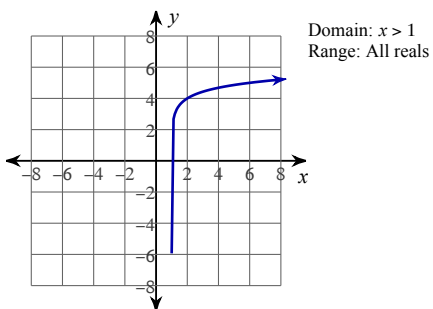


83) $y = \log_5(x - 1) + 4$

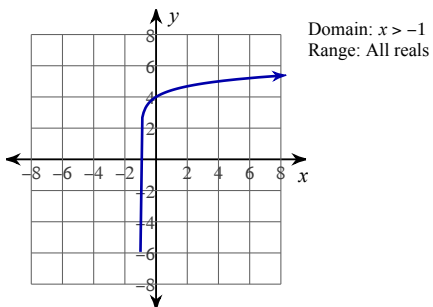
A)



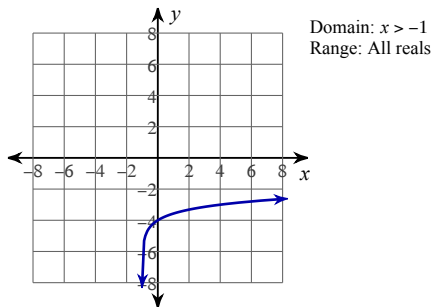
*B)



C)

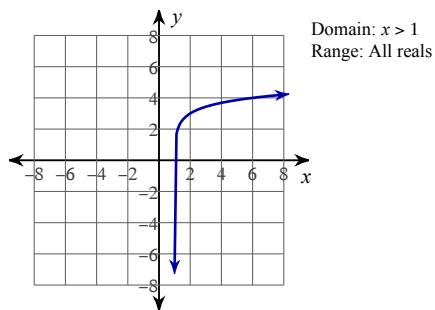


D)

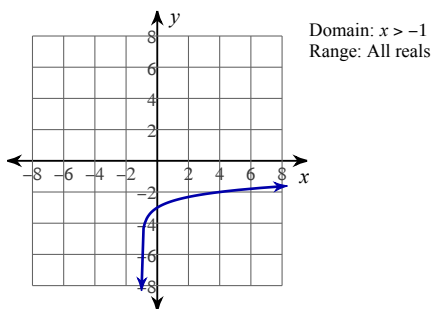


84) $y = \log_5(x - 1) + 3$

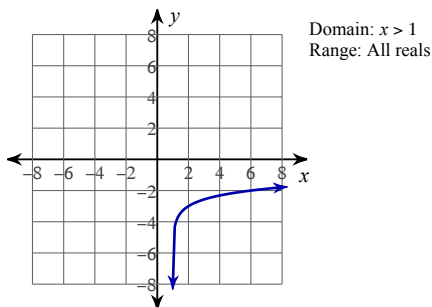
*A)



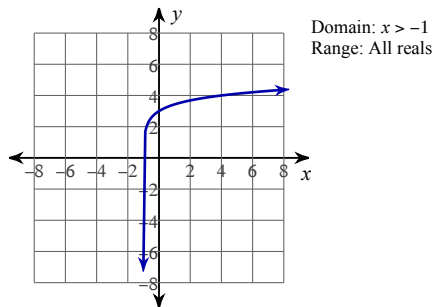
B)



C)

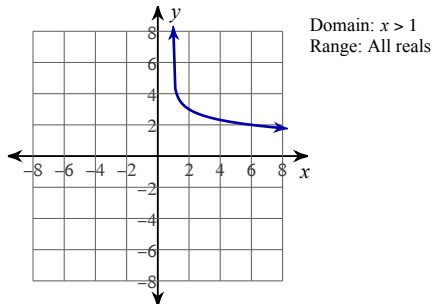


D)

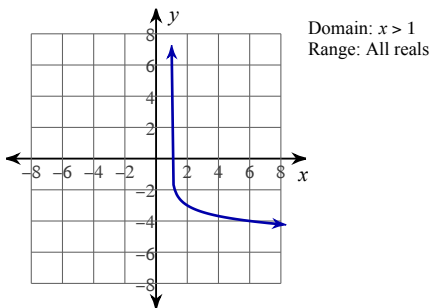


85) $y = \log_{\frac{1}{5}}(x - 1) + 3$

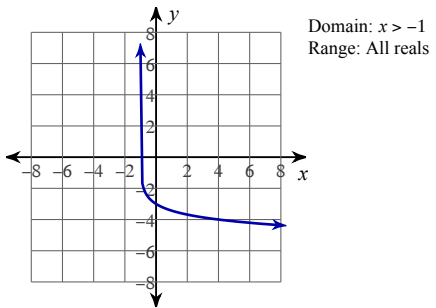
*A)



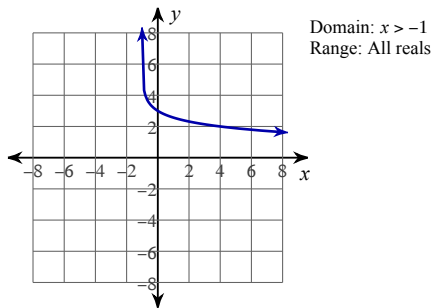
B)



C)

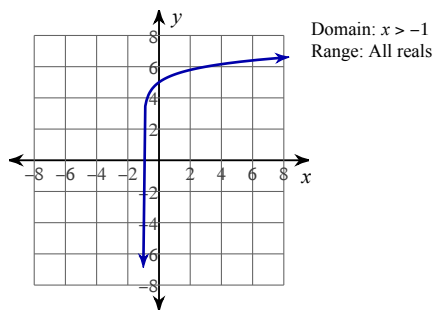


D)

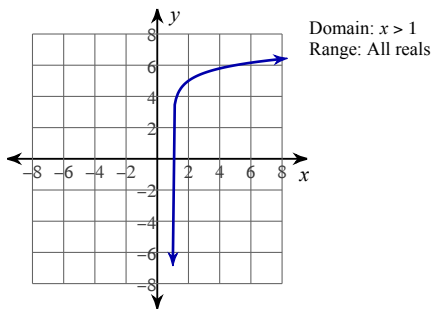


86) $y = \log_4(x - 1) - 5$

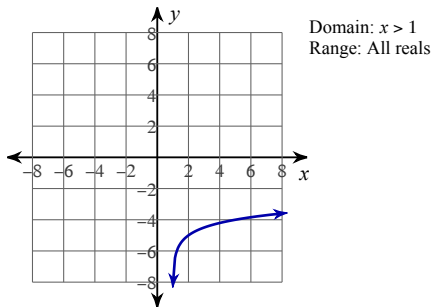
A)



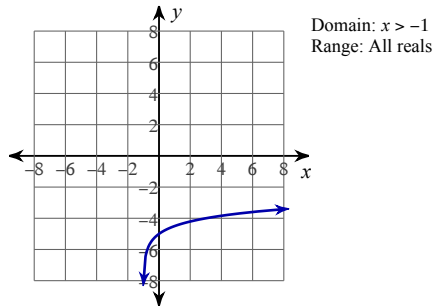
B)



*C)

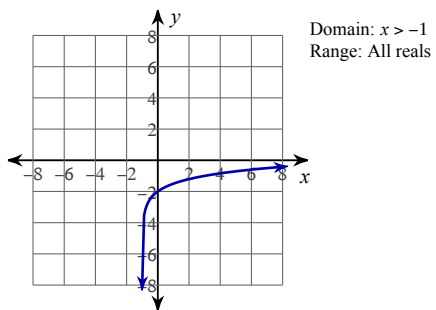


D)

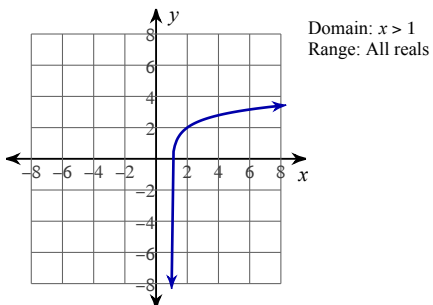


87) $y = \log_4(x - 1) + 2$

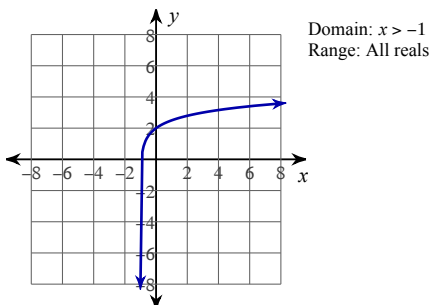
A)



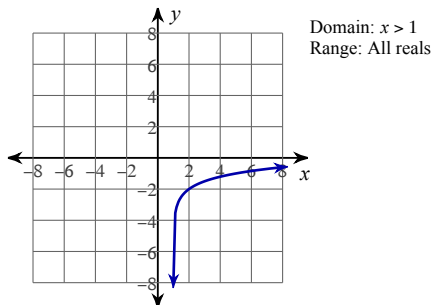
*B)



C)

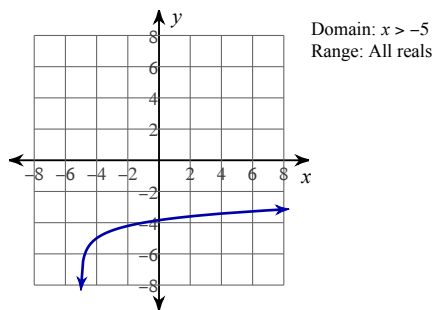


D)

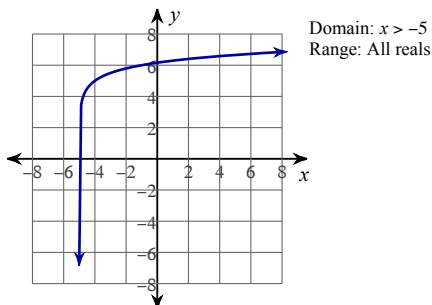


88) $y = \log_4(x + 5) + 5$

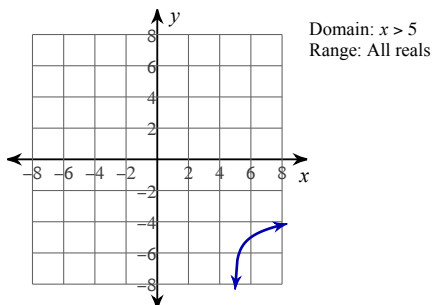
A)



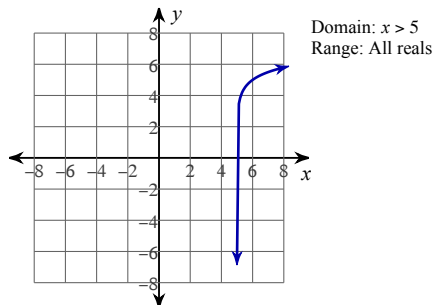
*B)



C)

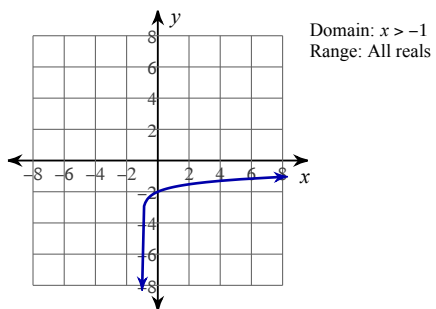


D)

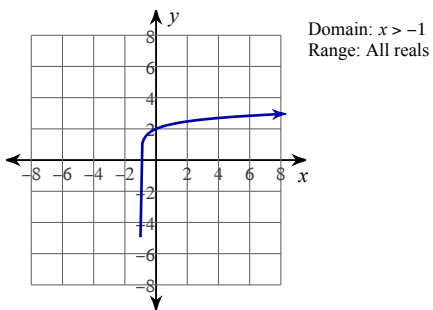


89) $y = \log(x - 1) - 2$

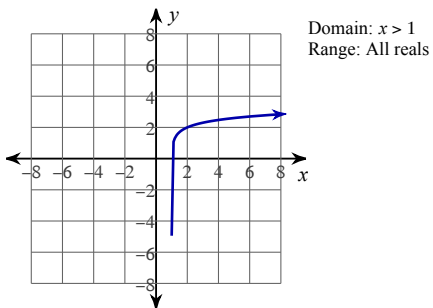
A)



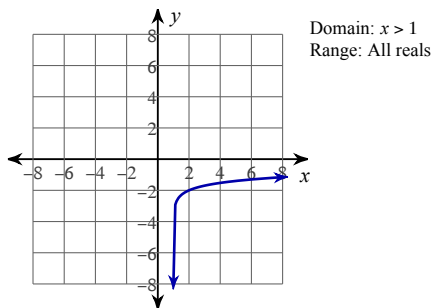
B)



C)

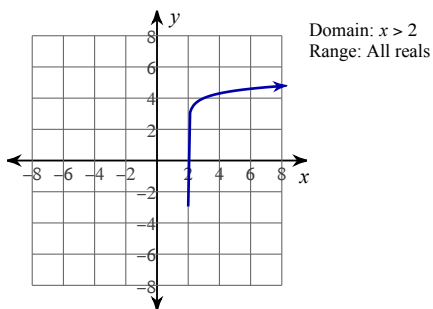


*D)

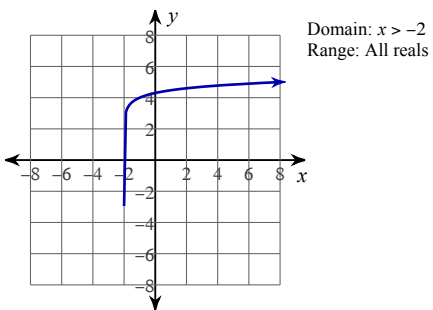


90) $y = \log(x - 2) - 4$

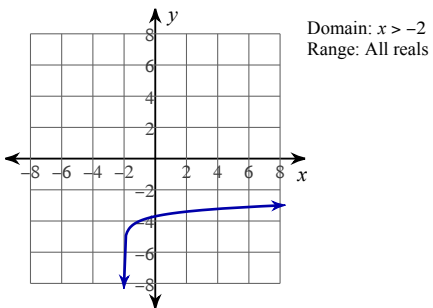
A)



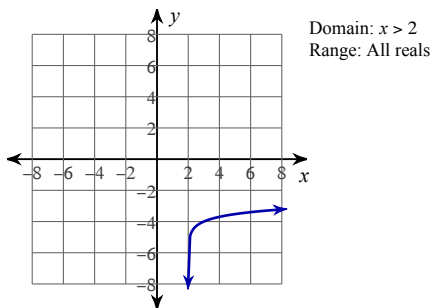
B)



C)

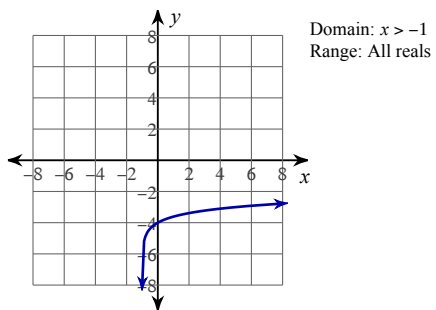


*D)

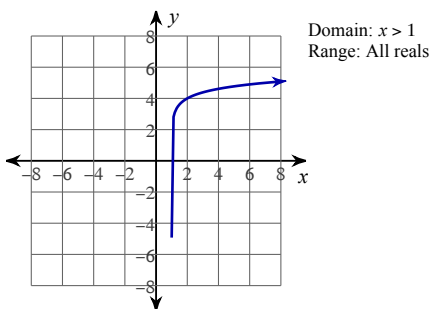


91) $y = \log_6(x - 1) - 4$

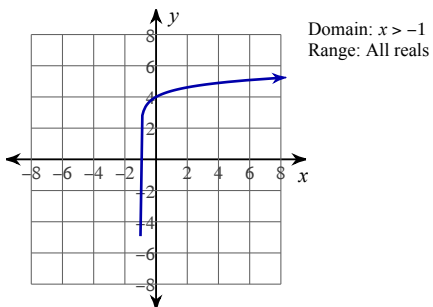
A)



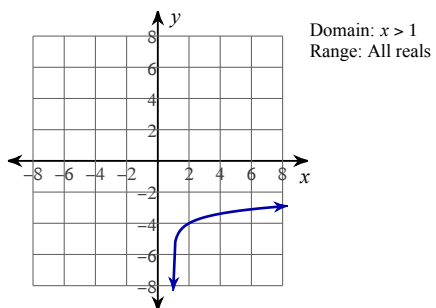
B)



C)

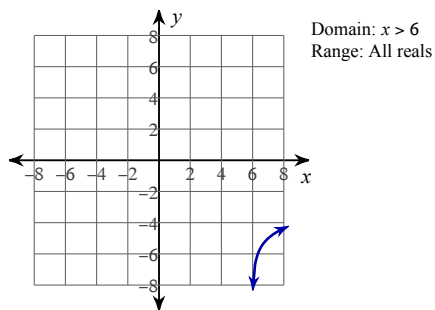


*D)

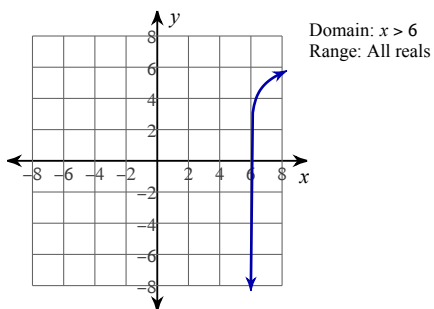


92) $y = \log_3(x + 6) + 5$

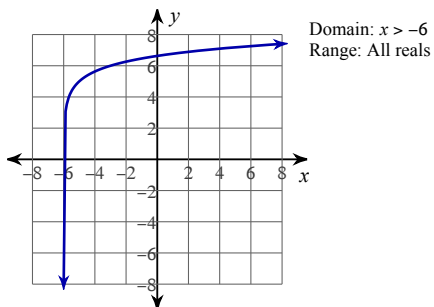
A)



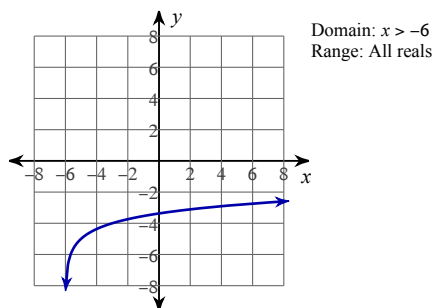
B)



*C)

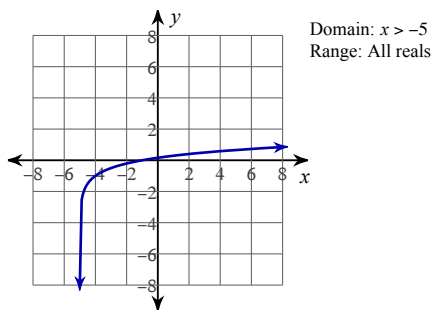


D)

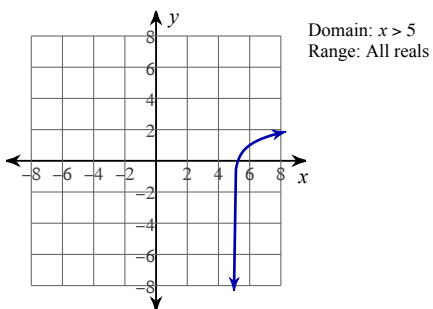


93) $y = \log_4(x + 5) - 1$

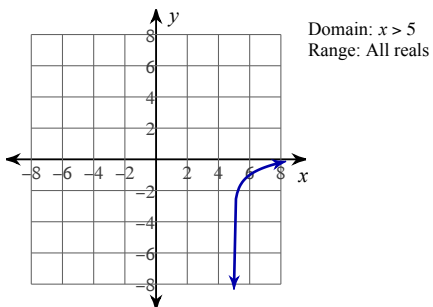
*A)



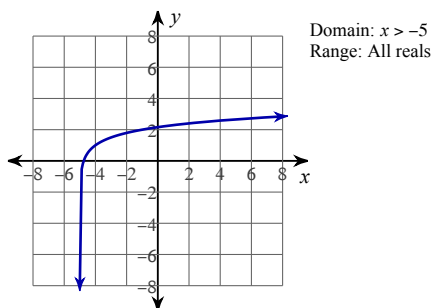
B)



C)

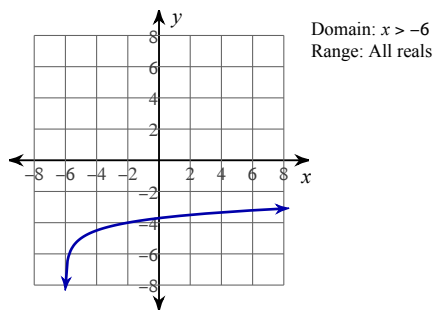


D)

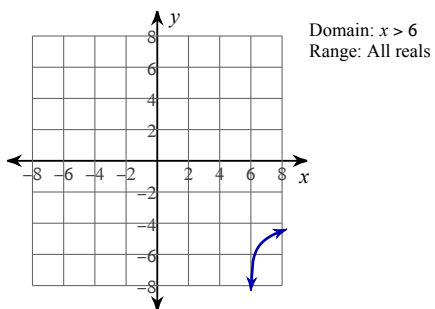


94) $y = \log_4(x + 6) + 5$

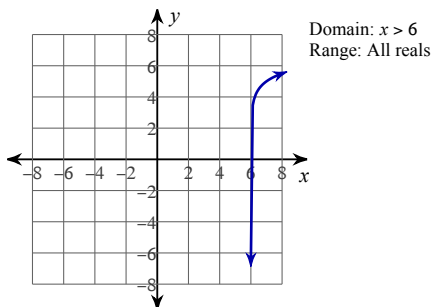
A)



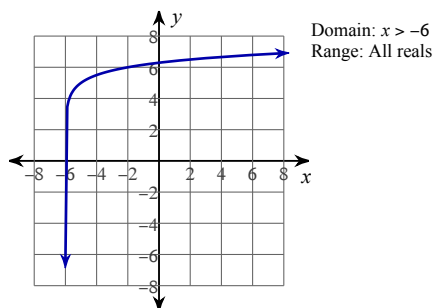
B)



C)

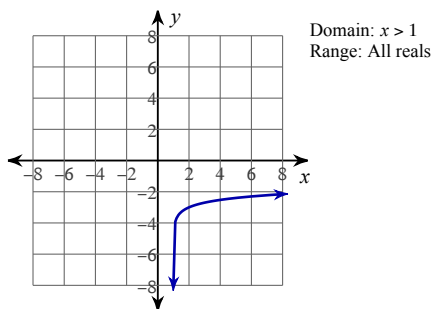


*D)

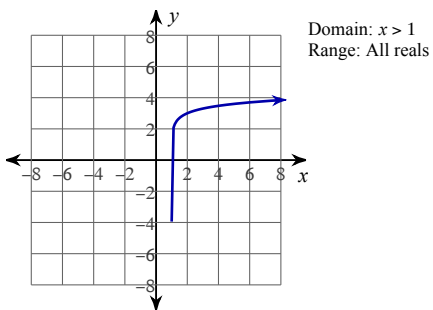


95) $y = \log(x - 1) - 3$

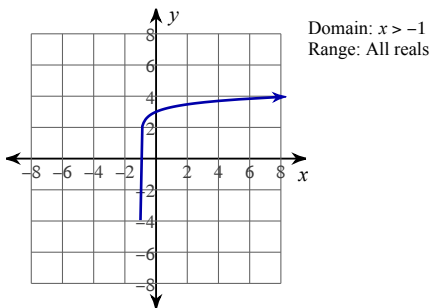
*A)



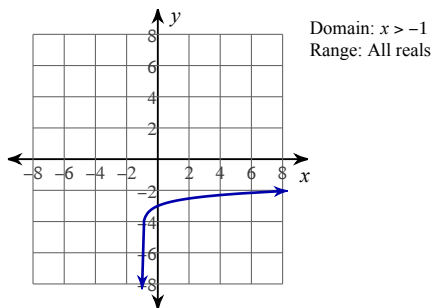
B)



C)

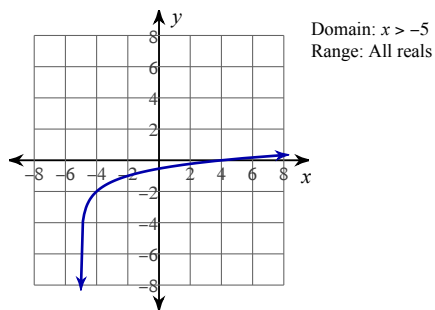


D)

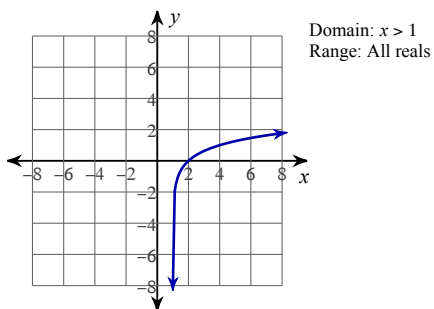


96) $y = \log_3(x - 1)$

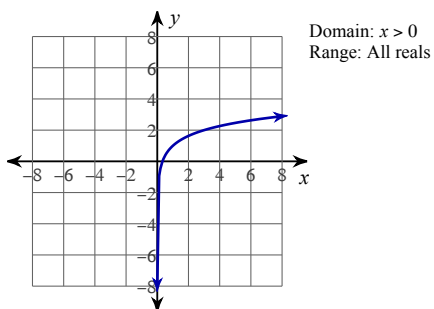
A)



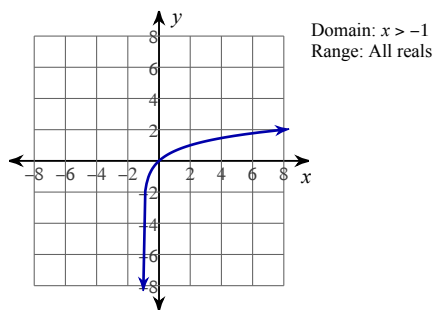
*B)



C)

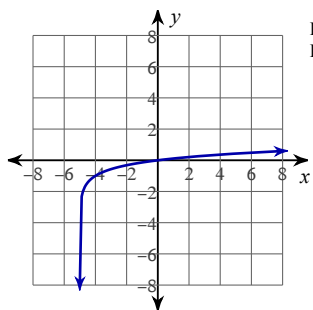


D)



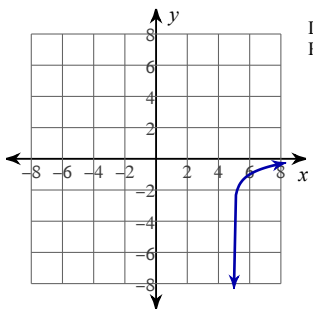
97) $y = \log_5(x + 5) + 1$

A)



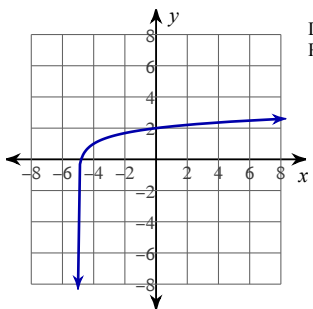
Domain: $x > -5$
Range: All reals

B)



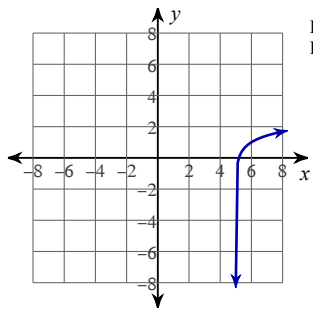
Domain: $x > 5$
Range: All reals

*C)



Domain: $x > -5$
Range: All reals

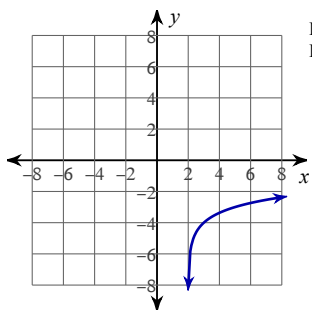
D)



Domain: $x > 5$
Range: All reals

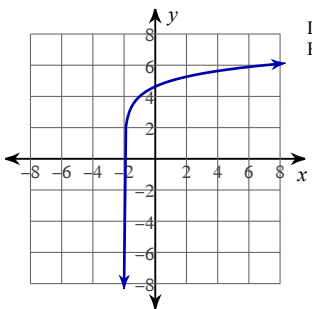
98) $y = \log_3(x - 2) + 4$

A)



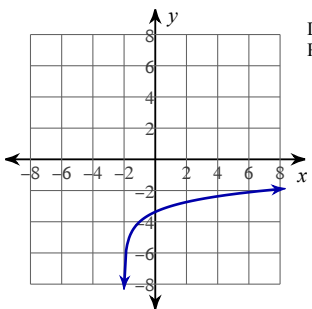
Domain: $x > 2$
Range: All reals

B)



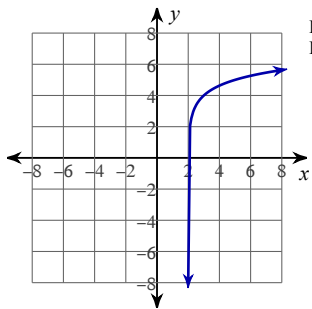
Domain: $x > -2$
Range: All reals

C)



Domain: $x > -2$
Range: All reals

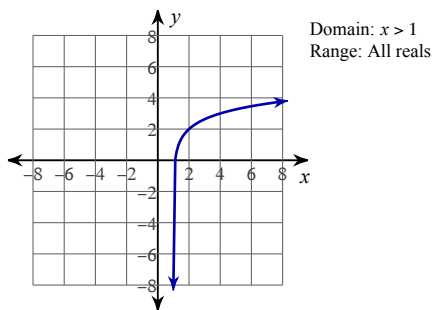
*D)



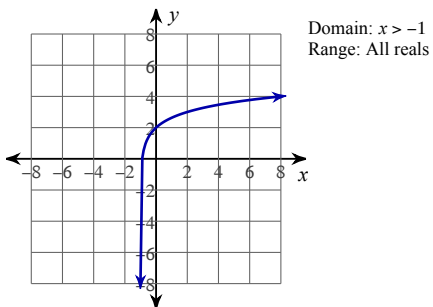
Domain: $x > 2$
Range: All reals

99) $y = \log_3(x - 1) + 2$

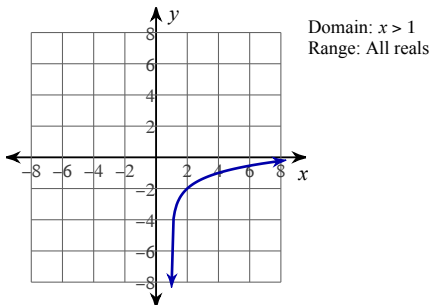
*A)



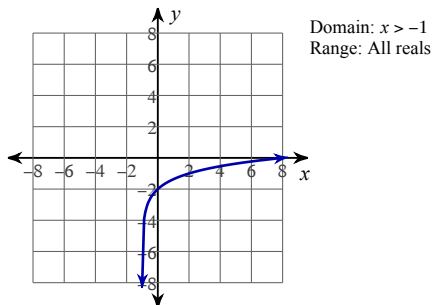
B)



C)

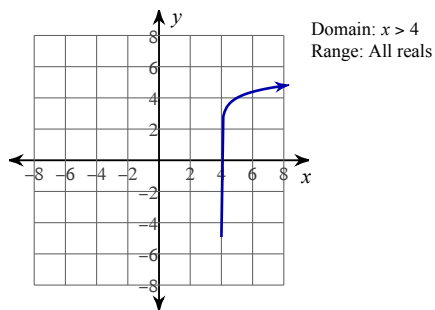


D)

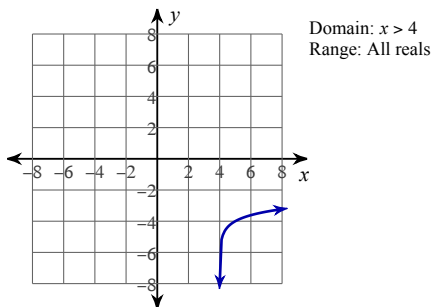


100) $y = \log_6(x + 4) - 4$

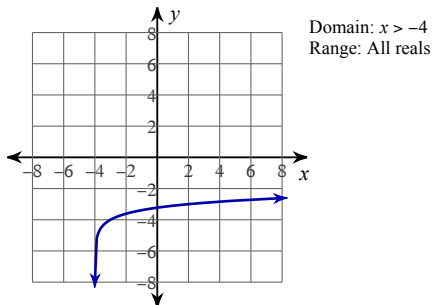
A)



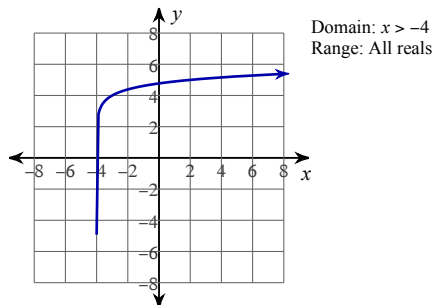
B)



*C)

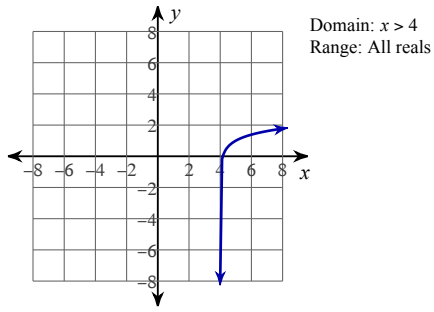


D)

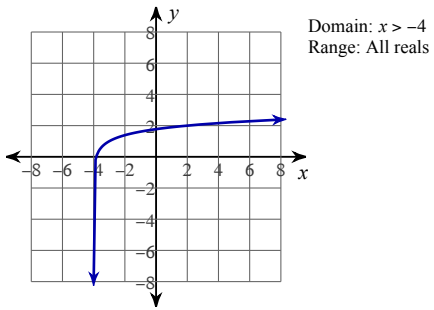


101) $y = \log_6(x + 4) - 1$

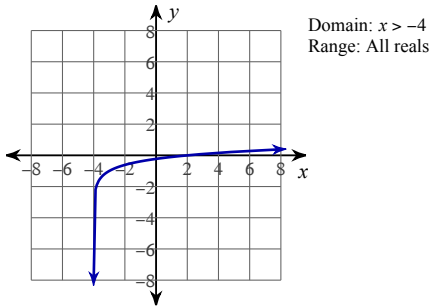
A)



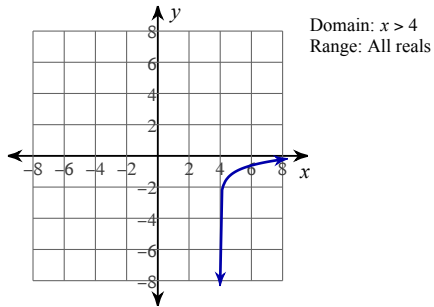
B)



*C)

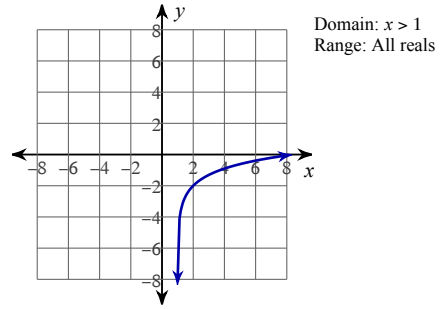


D)

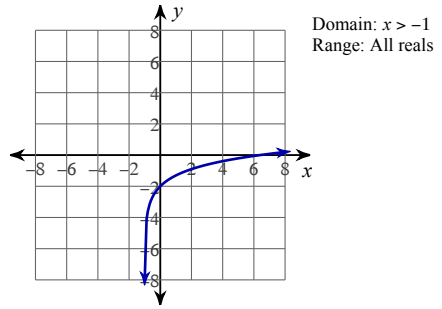


102) $y = \ln(x - 1) + 2$

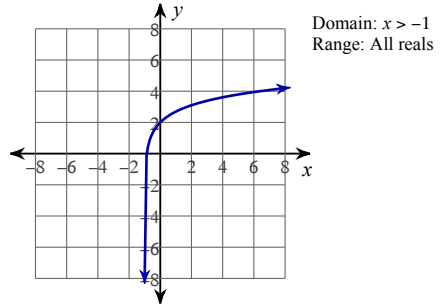
A)



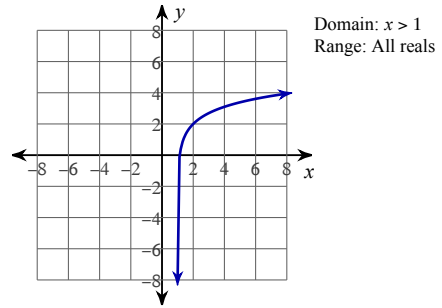
B)



C)

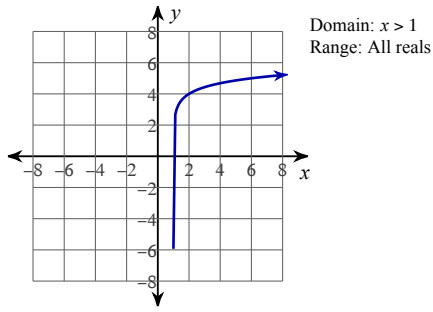


*D)

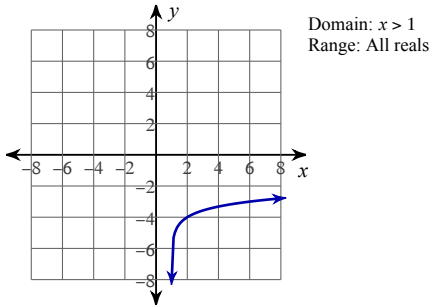


103) $y = \log_5(x + 1) + 4$

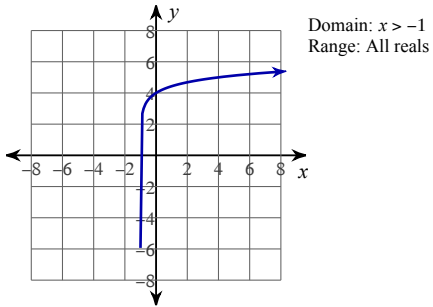
A)



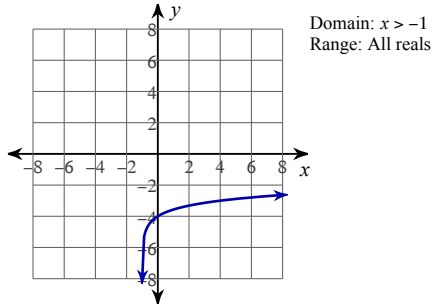
B)



*C)

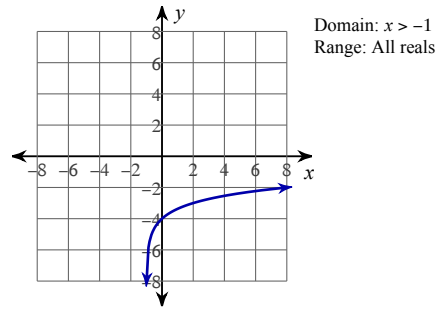


D)

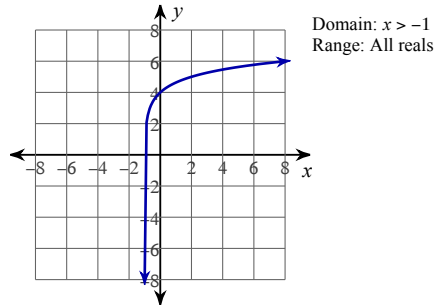


104) $y = \log_3(x - 1) + 4$

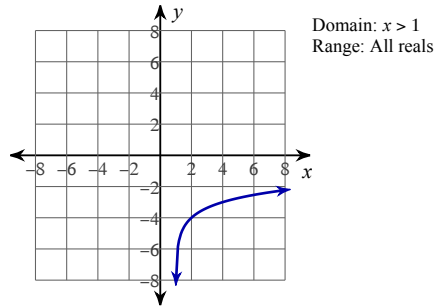
A)



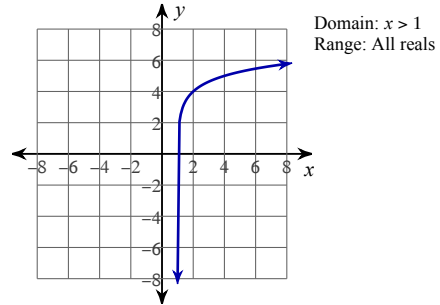
B)



C)

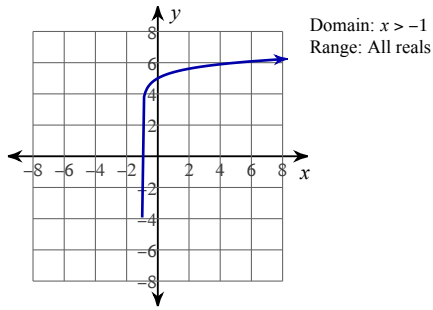


*D)

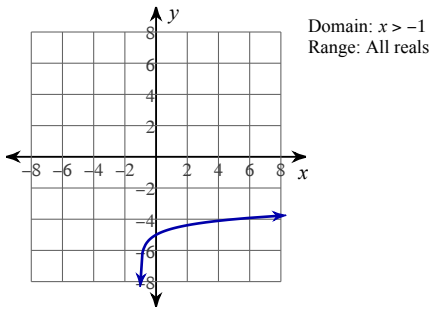


105) $y = \log_6(x - 1) + 5$

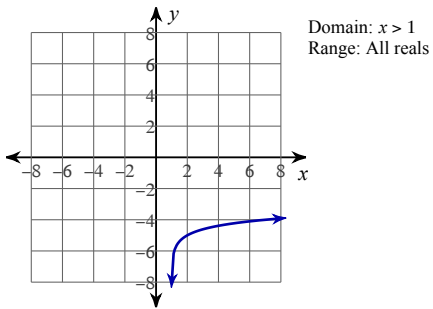
A)



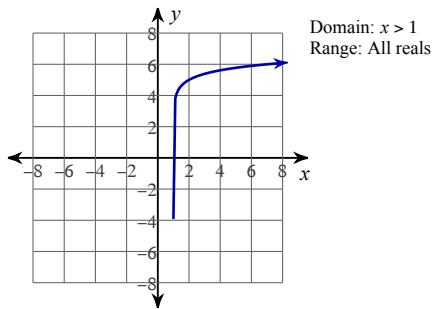
B)



C)

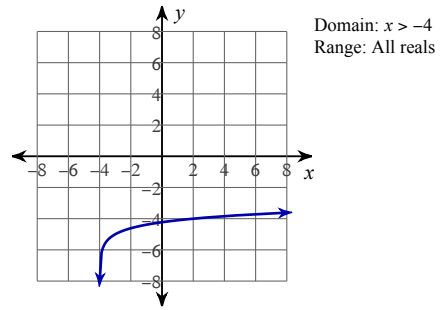


*D)

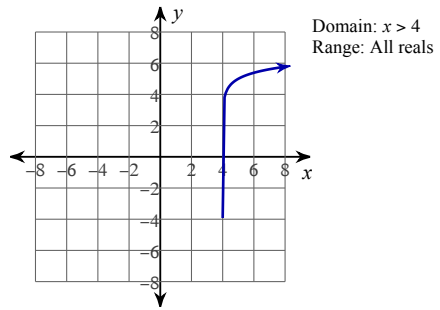


106) $y = \log_6(x + 4) - 5$

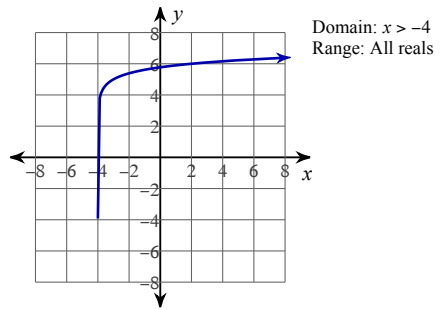
*A)



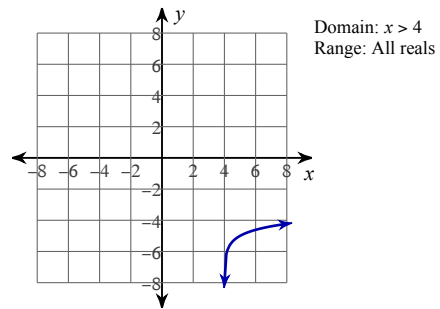
B)



C)

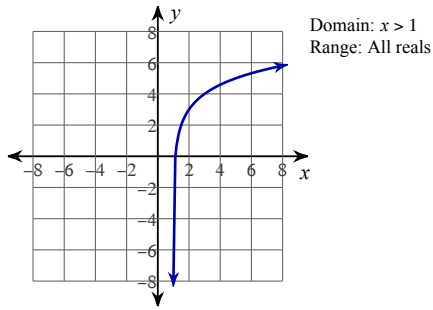


D)

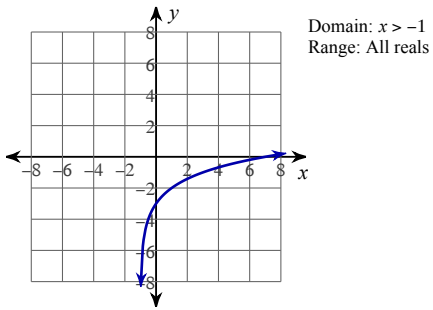


107) $y = \log_2(x - 1) - 3$

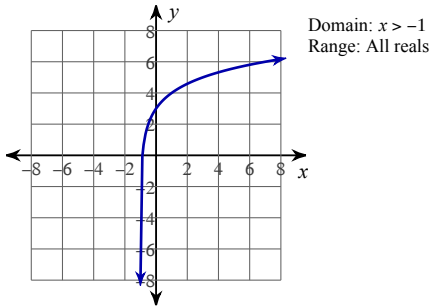
A)



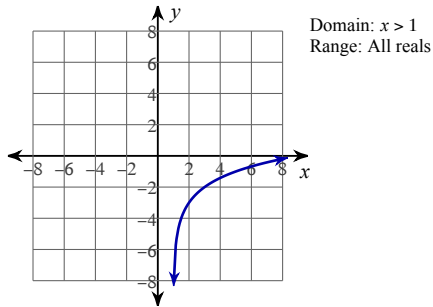
B)



C)

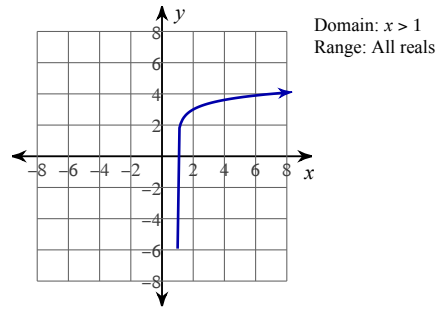


*D)

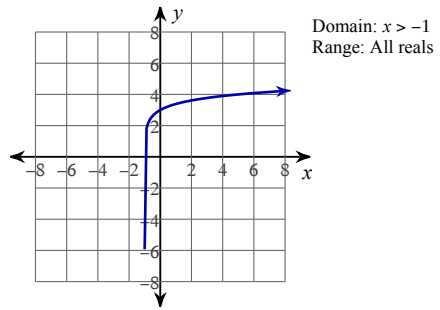


108) $y = \log_6(x - 1) + 3$

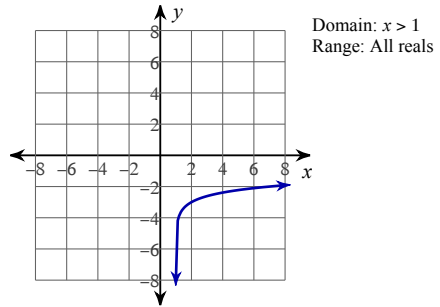
*A)



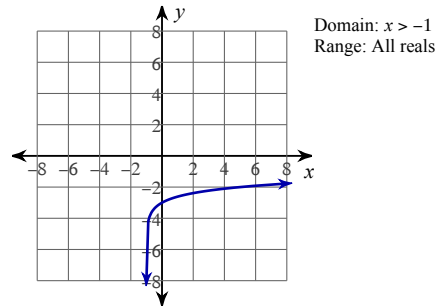
B)



C)

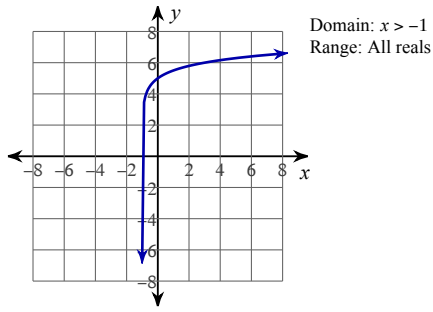


D)

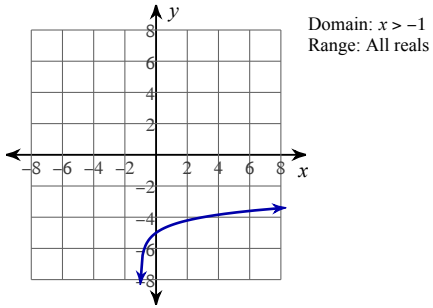


109) $y = \log_4(x - 1) + 5$

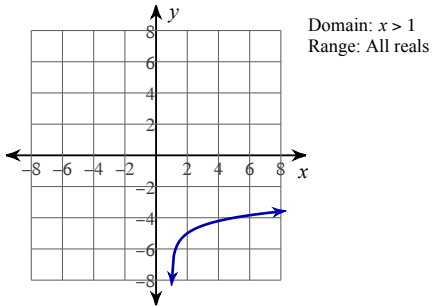
A)



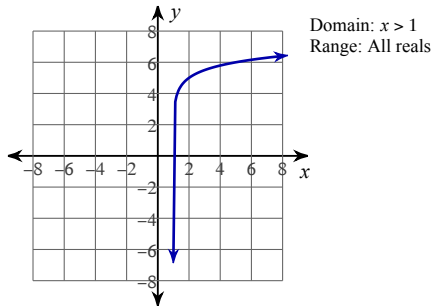
B)



C)

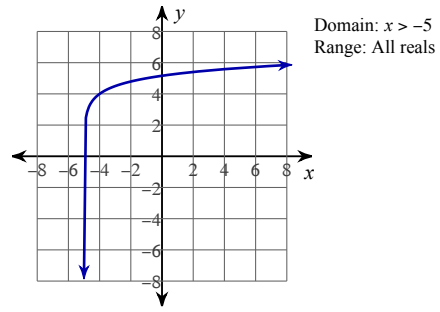


*D)

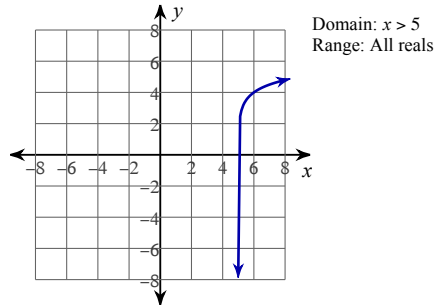


110) $y = \log_4(x + 5) + 4$

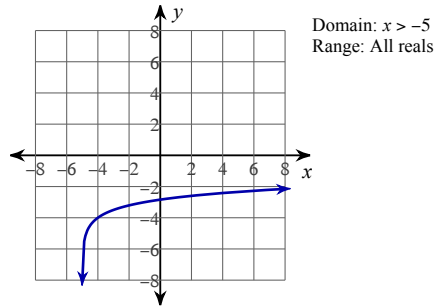
*A)



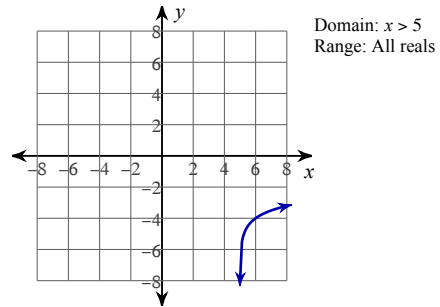
B)



C)

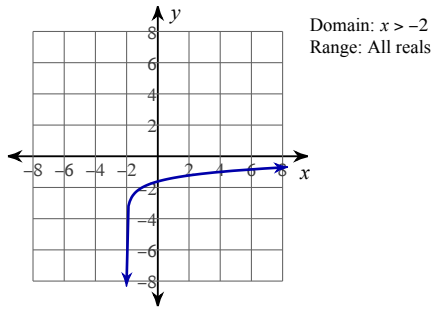


D)

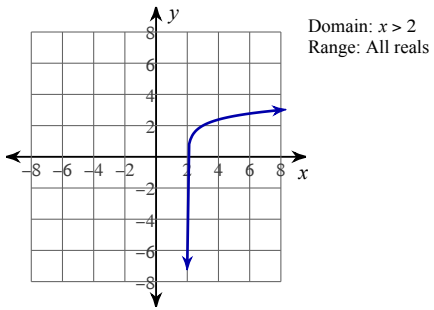


111) $y = \log_6(x + 2) - 2$

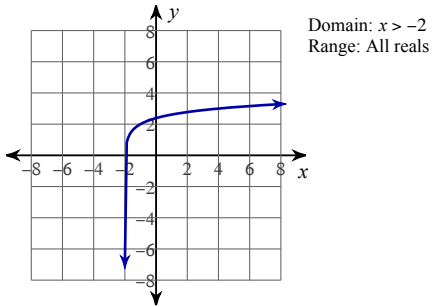
*A)



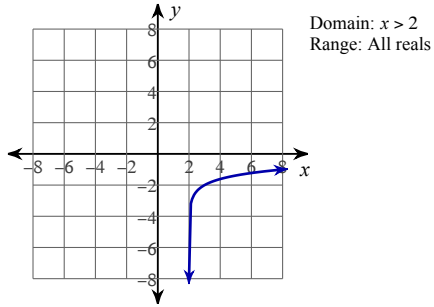
B)



C)

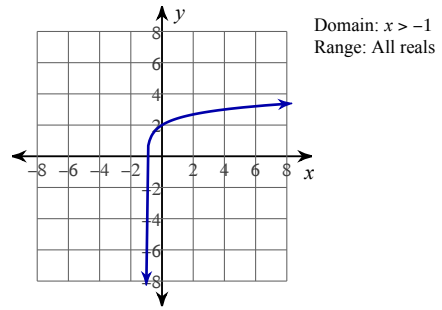


D)

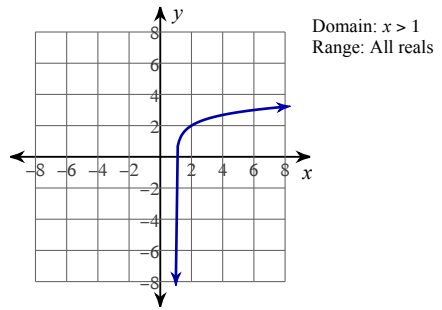


112) $y = \log_5(x - 1) + 2$

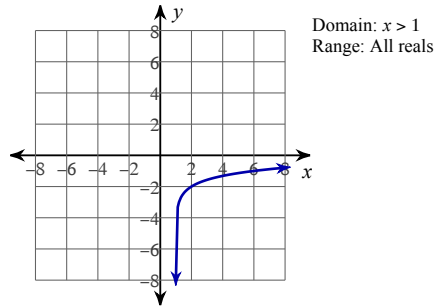
A)



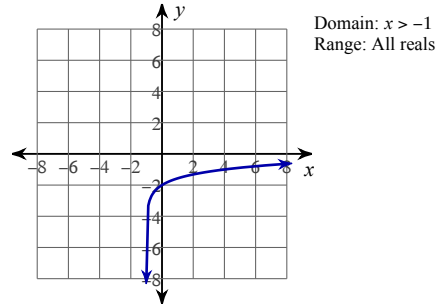
*B)



C)

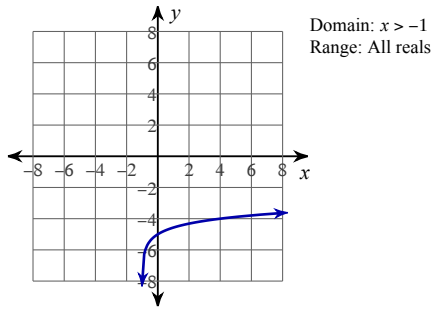


D)

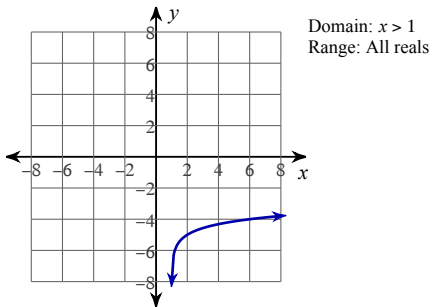


113) $y = \log_5(x - 1) + 5$

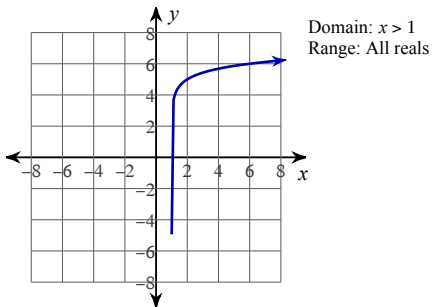
A)



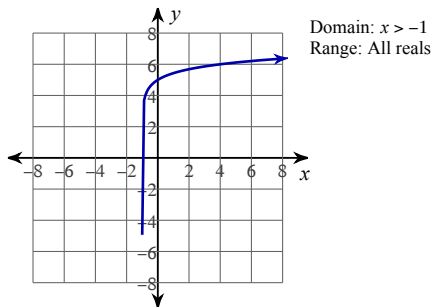
B)



*C)

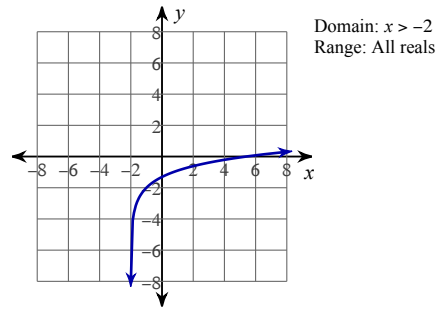


D)

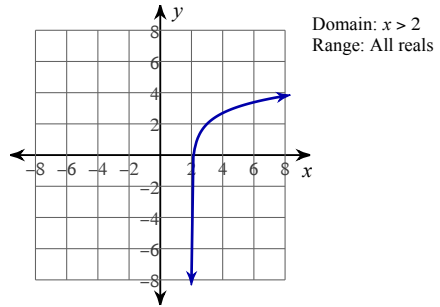


114) $y = \ln(x - 2) + 2$

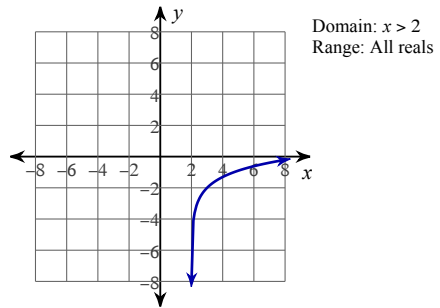
A)



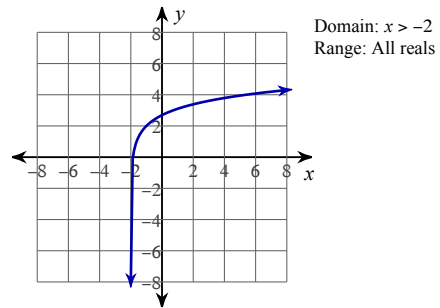
*B)



C)

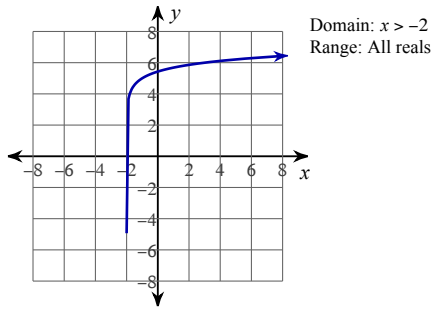


D)

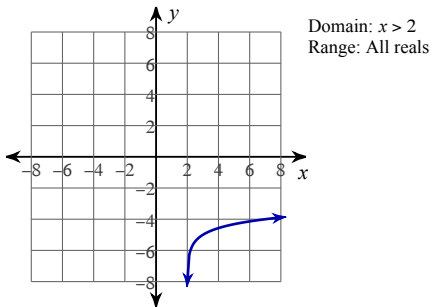


115) $y = \log_5(x - 2) + 5$

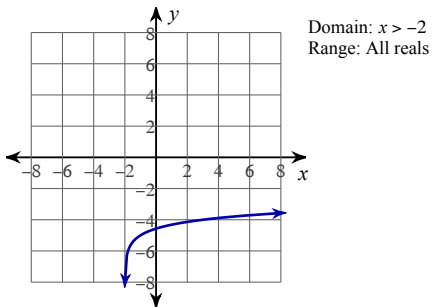
A)



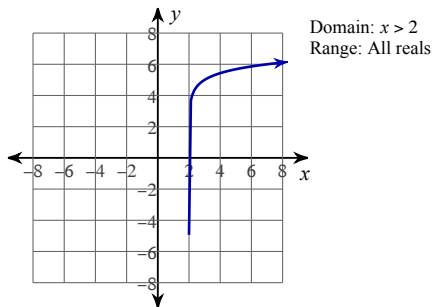
B)



C)

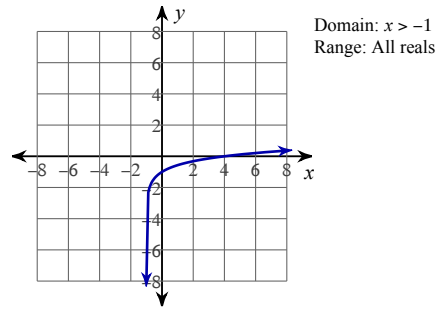


*D)

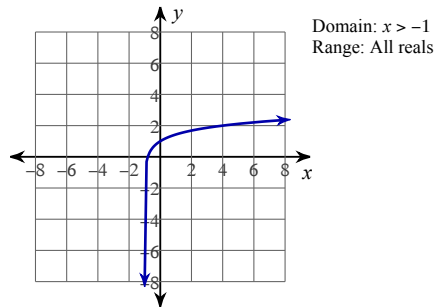


116) $y = \log_5(x - 1) + 1$

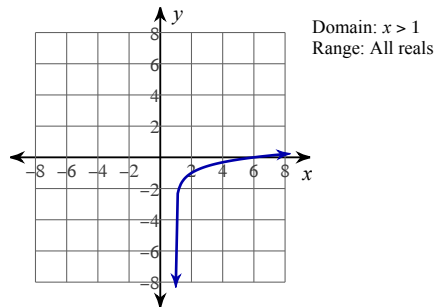
A)



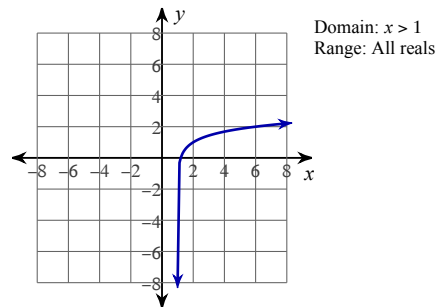
B)



C)

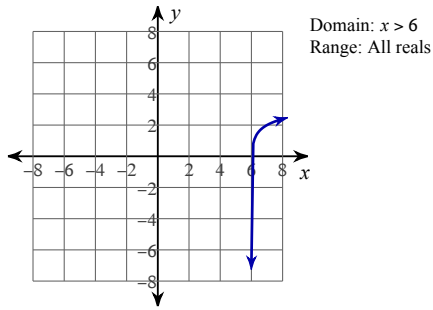


*D)

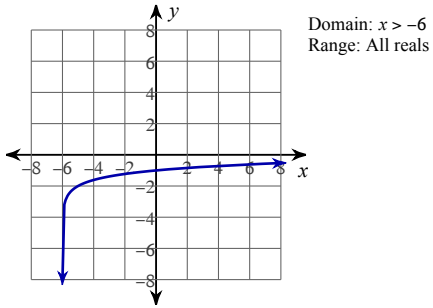


117) $y = \log_6(x + 6) - 2$

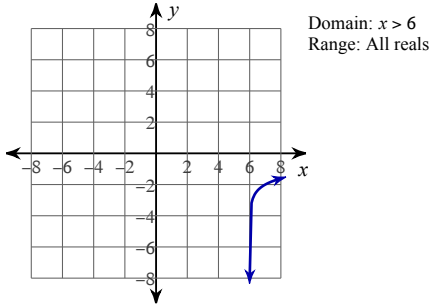
A)



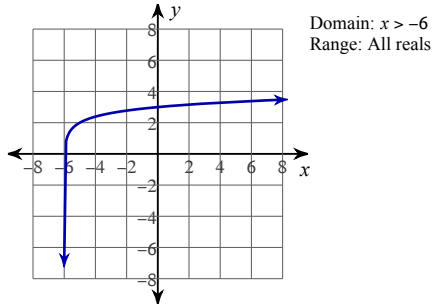
*B)



C)

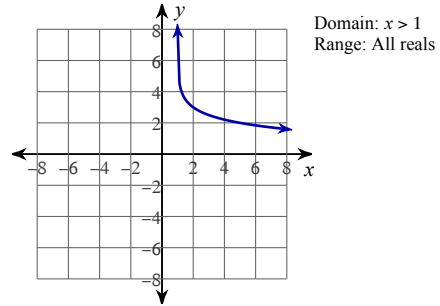


D)

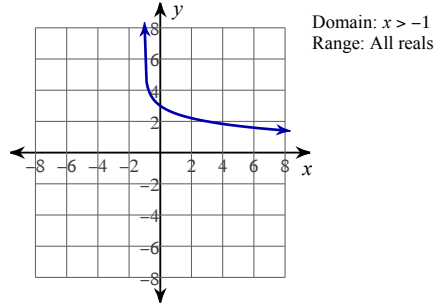


118) $y = \log_{\frac{1}{4}}(x - 1) - 3$

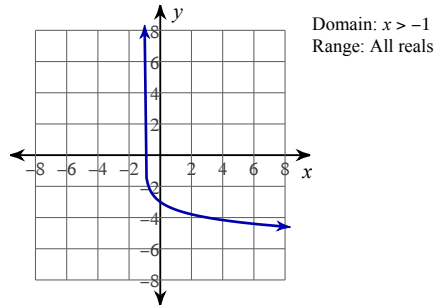
A)



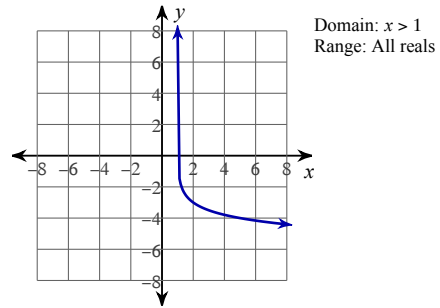
B)



C)

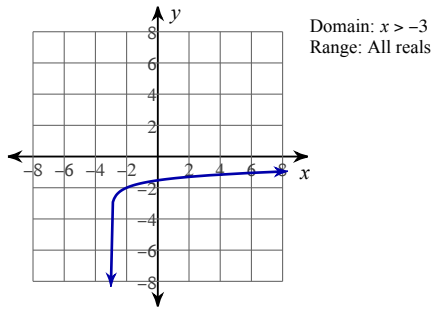


*D)

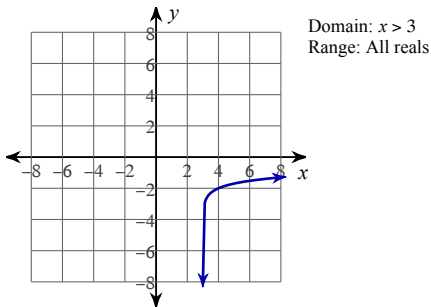


119) $y = \log(x + 3) - 2$

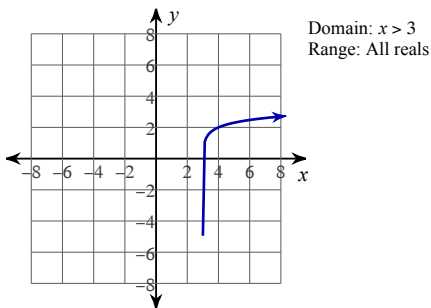
*A)



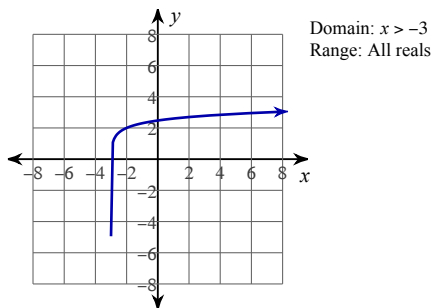
B)



C)

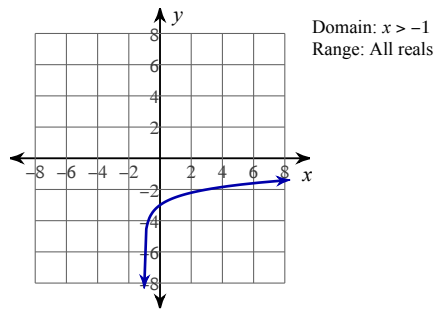


D)

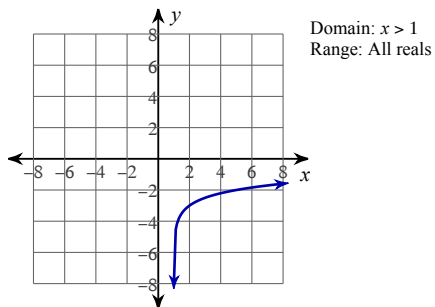


120) $y = \log_4(x - 1) + 3$

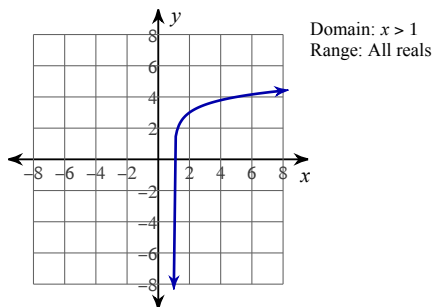
A)



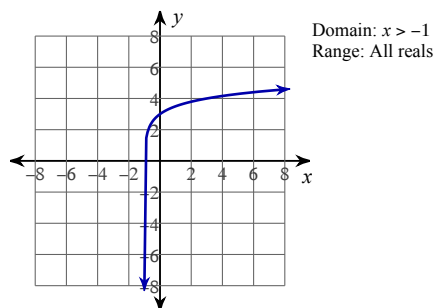
B)



*C)



D)



Expand each logarithm.

121) $\log_4 \left(\frac{6^5}{11} \right)^2$

*A) $10 \log_4 6 - 2 \log_4 11$

B) $5 \log_4 6 + 2 \log_4 11$

C) $\log_4 7 + \frac{\log_4 6}{2} + \frac{\log_4 11}{2}$

D) $10 \log_4 6 + 2 \log_4 11$

122) $\log_2 \sqrt[3]{5 \cdot 3 \cdot 8}$

A) $5 \log_2 5 + 5 \log_2 3$

*B) $\frac{\log_2 5}{3} + \frac{\log_2 3}{3} + 1$

C) $15 + \frac{\log_2 5}{3}$

D) $5 \log_2 5 - 25 \log_2 3$

$$123) \log_7 (2 \cdot 11 \cdot 5^2)$$

- A) $3 \log_7 2 - 6 \log_7 11$
 *B) $\log_7 2 + \log_7 11 + 2 \log_7 5$
 C) $2 \log_7 5 + \frac{\log_7 2}{3}$
 D) $2 \log_7 2 + 3 \log_7 11$

$$125) \log_8 (3 \sqrt[3]{10 \cdot 11})$$

- A) $8 \log_8 10 + 4 \log_8 11$
 B) $8 \log_8 10 - 4 \log_8 11$
 C) $2 \log_8 3 + \frac{\log_8 10}{3}$
 *D) $\log_8 3 + \frac{\log_8 10}{3} + \frac{\log_8 11}{3}$

$$127) \log_3 \left(\frac{a}{b^6} \right)^3$$

- *A) $3 \log_3 a - 18 \log_3 b$
 B) $18 \log_3 a + 3 \log_3 b$
 C) $\frac{\log_3 a}{2} + \frac{\log_3 b}{2} + \frac{\log_3 c}{2}$
 D) $3 \log_3 a + 18 \log_3 b$

$$129) \log_9 (u \cdot v \cdot w^3)$$

- A) $3 \log_9 u - 4 \log_9 v$
 B) $\frac{\log_9 u}{2} + \frac{\log_9 v}{2} + \frac{\log_9 w}{2}$
 *C) $\log_9 u + \log_9 v + 3 \log_9 w$
 D) $\log_9 w + \frac{\log_9 u}{2} + \frac{\log_9 v}{2}$

$$131) \log_9 (a^3 \cdot b)^6$$

- A) $\log_9 a + \log_9 b + 3 \log_9 c$
 B) $3 \log_9 a - 6 \log_9 b$
 C) $18 \log_9 a - 6 \log_9 b$
 *D) $18 \log_9 a + 6 \log_9 b$

$$124) \log_5 (3^5 \sqrt{2})$$

- A) $15 \log_5 2 - 3 \log_5 7$
 *B) $5 \log_5 3 + \frac{\log_5 2}{2}$
 C) $15 \log_5 2 + 3 \log_5 7$
 D) $\frac{\log_5 2}{2} + \frac{\log_5 7}{2} + \frac{\log_5 3}{2}$

$$126) \log_8 (10^6 \cdot 3)^2$$

- A) $\log_8 11 + \frac{\log_8 10}{3} + \frac{\log_8 3}{3}$
 B) $\log_8 10 + \log_8 3 + 6 \log_8 11$
 C) $2 \log_8 10 - 12 \log_8 3$
 *D) $12 \log_8 10 + 2 \log_8 3$

$$128) \log_7 (u^5 \cdot v)^5$$

- A) $\log_7 u + \log_7 v + 5 \log_7 w$
 B) $25 \log_7 u - 5 \log_7 v$
 C) $\log_7 w + \frac{\log_7 u}{3} + \frac{\log_7 v}{3}$
 *D) $25 \log_7 u + 5 \log_7 v$

$$130) \log_4 (c \sqrt[3]{a \cdot b})$$

- A) $2 \log_4 a + 10 \log_4 b$
 *B) $\log_4 c + \frac{\log_4 a}{3} + \frac{\log_4 b}{3}$
 C) $\frac{\log_4 a}{3} + \frac{\log_4 b}{3} + \frac{\log_4 c}{3}$
 D) $\log_4 a + \log_4 b + 5 \log_4 c$

$$132) \log_5 \sqrt{u \cdot v \cdot w}$$

- *A) $\frac{\log_5 u}{2} + \frac{\log_5 v}{2} + \frac{\log_5 w}{2}$
 B) $\log_5 u + \log_5 v + 3 \log_5 w$
 C) $3 \log_5 u - 2 \log_5 v$
 D) $3 \log_5 w + \frac{\log_5 u}{2}$

$$133) \log_3 \sqrt[3]{11 \cdot 10 \cdot 7}$$

- A) $2\log_3 7 + \frac{\log_3 11}{3}$
 B) $\log_3 11 + \log_3 10 + 2\log_3 7$
 C) $2\log_3 11 + 4\log_3 10$
 *D) $\frac{\log_3 11}{3} + \frac{\log_3 10}{3} + \frac{\log_3 7}{3}$

$$135) \log_2 (x^3 \cdot y)^3$$

- *A) $9\log_2 x + 3\log_2 y$
 B) $\log_2 x + \log_2 y + 3\log_2 z$
 C) $\log_2 z + \frac{\log_2 x}{3} + \frac{\log_2 y}{3}$
 D) $3\log_2 x + 9\log_2 y$

$$137) \log_6 \left(\frac{u}{v^6} \right)^2$$

- A) $6\log_6 u - 2\log_6 v$
 B) $6\log_6 u + 2\log_6 v$
 C) $\log_6 w + \frac{\log_6 u}{2} + \frac{\log_6 v}{2}$
 *D) $2\log_6 u - 12\log_6 v$

$$139) \log_5 (7^4 \sqrt[3]{10})$$

- A) $\frac{\log_5 10}{3} + \frac{\log_5 11}{3} + \frac{\log_5 7}{3}$
 B) $12\log_5 10 + 3\log_5 11$
 *C) $4\log_5 7 + \frac{\log_5 10}{3}$
 D) $3\log_5 10 + 12\log_5 11$

$$141) \log_8 (a^4 \cdot b)^2$$

- A) $\log_8 a + \log_8 b + 4\log_8 c$
 *B) $8\log_8 a + 2\log_8 b$
 C) $2\log_8 a - 8\log_8 b$
 D) $\frac{\log_8 a}{2} + \frac{\log_8 b}{2} + \frac{\log_8 c}{2}$

$$134) \log_6 (x^6 \cdot y)^2$$

- *A) $12\log_6 x + 2\log_6 y$
 B) $\frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$
 C) $2\log_6 x - 12\log_6 y$
 D) $6\log_6 x - 2\log_6 y$

$$136) \log_7 (5 \sqrt[3]{3 \cdot 8})$$

- *A) $\log_7 5 + \frac{\log_7 3}{3} + \frac{\log_7 8}{3}$
 B) $6\log_7 3 + 24\log_7 8$
 C) $4\log_7 5 + \frac{\log_7 3}{3}$
 D) $24\log_7 3 - 6\log_7 8$

$$138) \log_9 (5^6 \cdot 7)^5$$

- *A) $30\log_9 5 + 5\log_9 7$
 B) $5\log_9 5 + 30\log_9 7$
 C) $\frac{\log_9 5}{2} + \frac{\log_9 7}{2} + \frac{\log_9 8}{2}$
 D) $5\log_9 5 - 30\log_9 7$

$$140) \log_8 \sqrt[3]{2 \cdot 7 \cdot 5}$$

- A) $\log_8 2 + \log_8 7 + 6\log_8 5$
 B) $\log_8 5 + \frac{\log_8 2}{3} + \frac{\log_8 7}{3}$
 *C) $\frac{\log_8 2}{3} + \frac{\log_8 7}{3} + \frac{\log_8 5}{3}$
 D) $6\log_8 2 + 6\log_8 7$

$$142) \log_7 (8 \cdot 5^4)^3$$

- *A) $3\log_7 8 + 12\log_7 5$
 B) $4\log_7 8 - 3\log_7 5$
 C) $\log_7 11 + \frac{\log_7 8}{3} + \frac{\log_7 5}{3}$
 D) $4\log_7 11 + \frac{\log_7 8}{3}$

$$143) \log_7 \frac{u^2}{v^5}$$

- *A) $2\log_7 u - 5\log_7 v$
- B) $\log_7 u + \log_7 v + 2\log_7 w$
- C) $5\log_7 u + 10\log_7 v$
- D) $10\log_7 u + 5\log_7 v$

$$145) \log_4 (x^3 \cdot y)^6$$

- A) $3\log_4 x - 6\log_4 y$
- B) $\log_4 z + \frac{\log_4 x}{2} + \frac{\log_4 y}{2}$
- C) $\frac{\log_4 x}{2} + \frac{\log_4 y}{2} + \frac{\log_4 z}{2}$
- *D) $18\log_4 x + 6\log_4 y$

$$147) \log_2 \frac{x^6}{y^4}$$

- A) $4\log_2 x + 24\log_2 y$
- B) $\frac{\log_2 x}{3} + \frac{\log_2 y}{3} + \frac{\log_2 z}{3}$
- C) $4\log_2 x - 24\log_2 y$
- *D) $6\log_2 x - 4\log_2 y$

$$149) \log_6 (x \cdot y \cdot z^4)$$

- *A) $\log_6 x + \log_6 y + 4\log_6 z$
- B) $4\log_6 x - 4\log_6 y$
- C) $\frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$
- D) $4\log_6 z + \frac{\log_6 x}{3}$

$$151) \log_9 \left(\frac{x^6}{y}\right)^2$$

- A) $2\log_9 x - 12\log_9 y$
- *B) $12\log_9 x - 2\log_9 y$
- C) $2\log_9 x + 12\log_9 y$
- D) $\frac{\log_9 x}{2} + \frac{\log_9 y}{2} + \frac{\log_9 z}{2}$

$$144) \log_5 \sqrt{6 \cdot 7 \cdot 11}$$

- A) $15\log_5 6 + 3\log_5 7$
- B) $5\log_5 11 + \frac{\log_5 6}{2}$
- C) $3\log_5 6 + 15\log_5 7$
- *D) $\frac{\log_5 6}{2} + \frac{\log_5 7}{2} + \frac{\log_5 11}{2}$

$$146) \log_8 \sqrt{x \cdot y \cdot z}$$

- *A) $\frac{\log_8 x}{2} + \frac{\log_8 y}{2} + \frac{\log_8 z}{2}$
- B) $\log_8 z + \frac{\log_8 x}{2} + \frac{\log_8 y}{2}$
- C) $\log_8 x + \log_8 y + 2\log_8 z$
- D) $2\log_8 z + \frac{\log_8 x}{2}$

$$148) \log_7 \frac{3^4}{10^6}$$

- A) $4\log_7 3 + 6\log_7 10$
- B) $\log_7 3 + \log_7 10 + 4\log_7 11$
- C) $6\log_7 3 - 24\log_7 10$
- *D) $4\log_7 3 - 6\log_7 10$

$$150) \log_6 \left(\frac{3}{8^5}\right)^4$$

- A) $5\log_6 3 + 4\log_6 8$
- B) $5\log_6 5 + \frac{\log_6 3}{2}$
- *C) $4\log_6 3 - 20\log_6 8$
- D) $20\log_6 3 + 4\log_6 8$

$$152) \log_2 \left(\frac{8}{5^6}\right)^5$$

- A) $18 + 5\log_2 5$
- B) $6\log_2 11 + 1$
- *C) $15 - 30\log_2 5$
- D) $90 - 5\log_2 5$

$$153) \log_4 \left(\frac{x}{y^5} \right)^4$$

- A) $20 \log_4 x + 4 \log_4 y$
 *B) $4 \log_4 x - 20 \log_4 y$
 C) $5 \log_4 x + 4 \log_4 y$
 D) $\log_4 z + \frac{\log_4 x}{3} + \frac{\log_4 y}{3}$

$$155) \log_5 \sqrt{10 \cdot 3 \cdot 7}$$

- A) $4 \log_5 10 + 4 \log_5 3$
 *B) $\frac{\log_5 10}{2} + \frac{\log_5 3}{2} + \frac{\log_5 7}{2}$
 C) $\log_5 7 + \frac{\log_5 10}{2} + \frac{\log_5 3}{2}$
 D) $16 \log_5 10 - 4 \log_5 3$

$$157) \log_5 (11^3 \sqrt{3})$$

- A) $3 \log_5 3 - 2 \log_5 7$
 *B) $3 \log_5 11 + \frac{\log_5 3}{2}$
 C) $\frac{\log_5 3}{2} + \frac{\log_5 7}{2} + \frac{\log_5 11}{2}$
 D) $2 \log_5 3 - 6 \log_5 7$

$$159) \log_9 (a^5 b^5)$$

- *A) $5 \log_9 a + 5 \log_9 b$
 B) $25 \log_9 a - 5 \log_9 b$
 C) $\frac{\log_9 a}{3} + \frac{\log_9 b}{3} + \frac{\log_9 c}{3}$
 D) $5 \log_9 a - 5 \log_9 b$

Condense each expression to a single logarithm.

$$161) 8 \log_4 u - 4 \log_4 v$$

- *A) $\log_4 \frac{u^8}{v^4}$ B) $\log_4 (vuw^2)$
 C) $\log_4 \sqrt[3]{wvu}$ D) $\log_4 (v^4 u^2)$

$$154) \log_4 (2^6 \cdot 7)^2$$

- A) $6 \log_4 2 - 2 \log_4 7$
 *B) $12 \log_4 2 + 2 \log_4 7$
 C) $6 \log_4 2 + 2 \log_4 7$
 D) $\frac{\log_4 2}{3} + \frac{\log_4 7}{3} + \frac{\log_4 11}{3}$

$$156) \log_9 (x^3 \cdot y)^4$$

- *A) $12 \log_9 x + 4 \log_9 y$
 B) $3 \log_9 z + \frac{\log_9 x}{2}$
 C) $3 \log_9 x + 4 \log_9 y$
 D) $\frac{\log_9 x}{2} + \frac{\log_9 y}{2} + \frac{\log_9 z}{2}$

$$158) \log_6 \left(\frac{a^3}{b} \right)^4$$

- *A) $12 \log_6 a - 4 \log_6 b$
 B) $\log_6 c + \frac{\log_6 a}{2} + \frac{\log_6 b}{2}$
 C) $3 \log_6 a - 4 \log_6 b$
 D) $\frac{\log_6 a}{2} + \frac{\log_6 b}{2} + \frac{\log_6 c}{2}$

$$160) \log_7 (ab^3)^5$$

- *A) $5 \log_7 a + 15 \log_7 b$
 B) $3 \log_7 c + \frac{\log_7 a}{2}$
 C) $3 \log_7 a + 5 \log_7 b$
 D) $15 \log_7 a + 5 \log_7 b$

$$162) 10 \log_6 x + 5 \log_6 y$$

- *A) $\log_6 (y^5 x^{10})$
 B) $\log_6 \frac{x^5}{y^{10}}$
 C) $\log_6 (z^2 \sqrt{x})$
 D) $\log_6 (yxz^2)$

163) $4\log_9 3 + 5\log_9 2$

- A) $\log_9 (2^{20} \cdot 3^5)$
- B) $\log_9 \frac{3^4}{2^5}$
- *C) $\log_9 (2^5 \cdot 3^4)$
- D) $\log_9 (11\sqrt[3]{6})$

165) $4\log_6 u + 8\log_6 v$

- A) $\log_6 (w^2\sqrt{u})$
- *B) $\log_6 (v^8u^4)$
- C) $\log_6 (vuw^2)$
- D) $\log_6 \frac{u^2}{v^4}$

167) $20\log_7 3 - 4\log_7 2$

- *A) $\log_7 \frac{3^{20}}{2^4}$
- B) $\log_7 (2^{20} \cdot 3^4)$
- C) $\log_7 \frac{3^5}{2^4}$
- D) $\log_7 \sqrt[3]{30}$

169) $6\log_3 12 - 3\log_3 7$

- A) $\log_3 (84 \cdot 11^6)$
- *B) $\log_3 \frac{12^6}{7^3}$
- C) $\log_3 \frac{12^3}{7^{18}}$
- D) $\log_3 \sqrt[3]{924}$

171) $\log_3 x + \log_3 y + 5\log_3 z$

- *A) $\log_3 (yxz^5)$
- B) $\log_3 \frac{x^5}{y^{25}}$
- C) $\log_3 (y^{25}x^5)$
- D) $\log_3 (y^5x^{25})$

164) $4\log_2 10 - 2\log_2 7$

- A) $\log_2 (7^8 \cdot 10^2)$
- B) $\log_2 (3^4\sqrt[3]{10})$
- C) $\log_2 (70 \cdot 3^4)$
- *D) $\log_2 \frac{10^4}{7^2}$

166) $\frac{\log_2 7}{3} + \frac{\log_2 3}{3} + \frac{\log_2 5}{3}$

- A) $\log_2 (5^2\sqrt[3]{7})$
- *B) $\log_2 \sqrt[3]{105}$
- C) $\log_2 (3^3 \cdot 7^6)$
- D) $\log_2 \frac{7^2}{3^3}$

168) $\log_4 z + \frac{\log_4 x}{2} + \frac{\log_4 y}{2}$

- A) $\log_4 (y^6x^3)$
- *B) $\log_4 (z\sqrt{yx})$
- C) $\log_4 (y^3x^2)$
- D) $\log_4 \frac{x^6}{y^3}$

170) $\log_6 z + \frac{\log_6 x}{3} + \frac{\log_6 y}{3}$

- A) $\log_6 \frac{x^6}{y^{24}}$
- B) $\log_6 (yxz^4)$
- *C) $\log_6 (z\sqrt[3]{yx})$
- D) $\log_6 (y^6x^{24})$

172) $\log_6 x + \log_6 y + 3\log_6 z$

- A) $\log_6 (z^3\sqrt[3]{x})$
- B) $\log_6 \frac{x^3}{y^6}$
- *C) $\log_6 (yxz^3)$
- D) $\log_6 (y^{18}x^6)$

173) $\ln x + \ln y + 3 \ln z$

- A) $\ln (y^6 x^2)$ B) $\ln \frac{x^3}{y^2}$
 *C) $\ln (yxz^3)$ D) $\ln \sqrt[3]{zyx}$

175) $6 \log_2 6 + 12 \log_2 5$

- A) $\log_2 (5^6 \cdot 6^{12})$
 B) $\log_2 (5^6 \cdot 6^2)$
 C) $\log_2 (7^2 \sqrt{6})$
 *D) $\log_2 (5^{12} \cdot 6^6)$

177) $\log_7 x + \log_7 y + 2 \log_7 z$

- *A) $\log_7 (yxz^2)$ B) $\log_7 \sqrt{zyx}$
 C) $\log_7 (y^8 x^4)$ D) $\log_7 (y^4 x^2)$

179) $2 \log_7 x - 2 \log_7 y$

- A) $\log_7 (yxz^2)$ B) $\log_7 \frac{x^4}{y^2}$
 *C) $\log_7 \frac{x^2}{y^2}$ D) $\log_7 (y^4 x^2)$

181) $2 \log_4 x + 10 \log_4 y$

- A) $\log_4 (y^2 x^5)$ *B) $\log_4 (y^{10} x^2)$
 C) $\log_4 \frac{x^{10}}{y^2}$ D) $\log_4 (y^2 x^{10})$

174) $5 \log_4 a + 20 \log_4 b$

- A) $\log_4 \frac{a^5}{b^{20}}$ B) $\log_4 (b^5 a^4)$
 C) $\log_4 \frac{a^{20}}{b^5}$ *D) $\log_4 (b^{20} a^5)$

176) $12 \log_8 x - 3 \log_8 y$

- A) $\log_8 (z \sqrt{yx})$ *B) $\log_8 \frac{x^{12}}{y^3}$
 C) $\log_8 (yxz^4)$ D) $\log_8 \frac{x^3}{y^{12}}$

178) $\frac{\log_5 3}{2} + \frac{\log_5 10}{2} + \frac{\log_5 7}{2}$

- *A) $\log_5 \sqrt{210}$
 B) $\log_5 (7 \sqrt{30})$
 C) $\log_5 \frac{3^3}{10^2}$
 D) $\log_5 (10^6 \cdot 3^2)$

180) $\log_9 x + \log_9 y + 6 \log_9 z$

- *A) $\log_9 (yxz^6)$
 B) $\log_9 (y^2 x^{12})$
 C) $\log_9 (z^6 \sqrt[3]{x})$
 D) $\log_9 \frac{x^{12}}{y^2}$

182) $3 \log_6 x - 9 \log_6 y$

- A) $\log_6 (z \sqrt[3]{yx})$
 B) $\log_6 \frac{x^3}{y^3}$
 *C) $\log_6 \frac{x^3}{y^9}$
 D) $\log_6 (yxz^3)$

183) $4 \log_5 a - 8 \log_5 b$

A) $\log_5 (c\sqrt{ba})$

B) $\log_5 (bac^2)$

*C) $\log_5 \frac{a^4}{b^8}$

D) $\log_5 (b^4 a^8)$

185) $3 \log_5 7 + 3 \log_5 10$

*A) $\log_5 (10^3 \cdot 7^3)$

B) $\log_5 (3^3 \sqrt[3]{7})$

C) $\log_5 (10^3 \cdot 7^9)$

D) $\log_5 (10^9 \cdot 7^3)$

187) $5 \log_2 11 + \frac{\log_2 3}{2}$

*A) $\log_2 (11^5 \sqrt{3})$

B) $\log_2 \sqrt{330}$

C) $\log_2 (11 \sqrt{30})$

D) $\log_2 \frac{3^{15}}{10^3}$

189) $5 \log_2 x + 20 \log_2 y$

*A) $\log_2 (y^{20} x^5)$ B) $\log_2 (y^5 x^4)$

C) $\log_2 (y^5 x^{20})$ D) $\log_2 \frac{x^5}{y^{20}}$

191) $\log_6 x + \log_6 y + 6 \log_6 z$

*A) $\log_6 (yxz^6)$

B) $\log_6 \frac{x^5}{y^{30}}$

C) $\log_6 (z \sqrt[3]{yx})$

D) $\log_6 (y^{30} x^5)$

184) $16 \ln x - 4 \ln y$

A) $\ln (y^4 x^4)$ B) $\ln \sqrt[3]{zyx}$

*C) $\ln \frac{x^{16}}{y^4}$ D) $\ln (z^4 \sqrt[3]{x})$

186) $3 \log_7 w + \frac{\log_7 u}{3}$

A) $\log_7 (v^4 u^3)$

B) $\log_7 \sqrt[3]{wvu}$

*C) $\log_7 (w^3 \sqrt[3]{u})$

D) $\log_7 \frac{u^3}{v^4}$

188) $4 \log_8 w + \frac{\log_8 u}{3}$

A) $\log_8 \frac{u^{16}}{v^4}$

*B) $\log_8 (w^4 \sqrt[3]{u})$

C) $\log_8 (v^4 u^{16})$

D) $\log_8 (v^{16} u^4)$

190) $2 \log_6 a - 8 \log_6 b$

A) $\log_6 (bac^4)$ B) $\log_6 (b^8 a^2)$

*C) $\log_6 \frac{a^2}{b^8}$ D) $\log_6 \sqrt[3]{cba}$

192) $2 \log_7 5 + 4 \log_7 8$

A) $\log_7 \sqrt{120}$

*B) $\log_7 (8^4 \cdot 5^2)$

C) $\log_7 \frac{5^2}{8^4}$

D) $\log_7 \frac{5^4}{8^2}$

$$193) \frac{\log_2 x}{3} + \frac{\log_2 y}{3} + \frac{\log_2 z}{3}$$

- A) $\log_2 \frac{x^9}{y^3}$
 *B) $\log_2 \sqrt[3]{zyx}$
 C) $\log_2 (y^9 x^3)$
 D) $\log_2 (z^3 \sqrt[3]{x})$

$$195) \frac{\log_2 x}{2} + \frac{\log_2 y}{2} + \frac{\log_2 z}{2}$$

- A) $\log_2 (z\sqrt{yx})$
 B) $\log_2 \frac{x^6}{y^{18}}$
 C) $\log_2 (z^3 \sqrt{x})$
 *D) $\log_2 \sqrt{zyx}$

$$197) 3 \log_2 a + 15 \log_2 b$$

- A) $\log_2 (c^3 \sqrt[3]{ba})$
 B) $\log_2 (c^5 \sqrt[3]{a})$
 C) $\log_2 \frac{a^3}{b^{15}}$
 *D) $\log_2 (b^{15} a^3)$

$$199) 6 \ln 7 - 24 \ln 11$$

- *A) $\ln \frac{7^6}{11^{24}}$ B) $\ln (8^4 \sqrt{7})$
 C) $\ln (11^6 \cdot 7^4)$ D) $\ln (8 \sqrt{77})$

$$194) \frac{\log_6 x}{3} + \frac{\log_6 y}{3} + \frac{\log_6 z}{3}$$

- A) $\log_6 (z\sqrt[3]{yx})$
 B) $\log_6 \frac{x^3}{y^9}$
 C) $\log_6 (y^3 x^9)$
 *D) $\log_6 \sqrt[3]{zyx}$

$$196) 18 \log_4 x - 3 \log_4 y$$

- A) $\log_4 \frac{x^6}{y^3}$
 *B) $\log_4 \frac{x^{18}}{y^3}$
 C) $\log_4 (z^6 \sqrt{x})$
 D) $\log_4 (y^3 x^6)$

$$198) \frac{\log_4 x}{3} + \frac{\log_4 y}{3} + \frac{\log_4 z}{3}$$

- A) $\log_4 \frac{x^9}{y^3}$
 B) $\log_4 (z\sqrt[3]{yx})$
 *C) $\log_4 \sqrt[3]{zyx}$
 D) $\log_4 (y^9 x^3)$

$$200) 12 \log_4 x + 6 \log_4 y$$

- *A) $\log_4 (y^6 x^{12})$
 B) $\log_4 (z^2 \sqrt{x})$
 C) $\log_4 (y^6 x^2)$
 D) $\log_4 (y^{12} x^6)$