

**Instructions to students: Use your text book to answer this test on Chapter 13.**

**Due Date: 16-07-2018**

## Multiple-choice questions

- 1 The expression  $6x^3 \div (3x^{-3})$  equals
- A 2
  - B  $2x^0$
  - C  $2x^6$
  - D  $2x^{-1}$
  - E  $\frac{2}{x^9}$
- 2 The expression  $(-a)^2(-a^2)(-a)^3(a)^2$  equals
- A  $a^9$
  - B  $-a^9$
  - C  $a^8$
  - D  $-a^8$
  - E  $a^{24}$
- 3 The expression  $36(w^2y^3)^2 \div 15(wy^2)^3$  equals
- A  $\frac{6w}{15}$
  - B  $\frac{12w}{5}$
  - C  $\frac{2y}{5w}$
  - D  $\frac{2w}{5}$
  - E  $\frac{2}{5w}$
- 4 The function  $f: \mathbb{R}^+ \rightarrow \mathbb{R}$ , where  $f(x) = \log_2 5x$ , has an inverse function,  $f^{-1}$ .  
The rule for  $f^{-1}$  is given by
- A  $f^{-1}(x) = 2^x$

**B**  $f^{-1}(x) = 5^x$

**C**  $f^{-1}(x) = \left(\frac{1}{5}\right)2^x$

**D**  $f^{-1}(x) = 2^{\frac{x}{5}}$

**E**  $f^{-1}(x) = \log_2\left(\frac{x}{5}\right)$

**5** The solution of the equation  $4 \times 2^{5x} = 64$  is

**A**  $x = \frac{1}{5}$

**B**  $x = \frac{4}{5}$

**C**  $x = \left(\frac{1}{5}\right)\log_2 60$

**D**  $x = \left(\frac{1}{2}\right)\log_2 16$

**E**  $x = \left(\frac{1}{5}\right)2^5$

**6** The equation of the asymptote of  $y = 5 \times 2^{x-1} + 4$  is

**A**  $x = 2$

**B**  $y = 0$

**C**  $y = 4$

**D**  $x = 1$

**E**  $y = 5$

**7** The equation of the asymptote of  $y = 4 \log_2(6x) + 3$  is

**A**  $x = 0$

**B**  $x = 2$

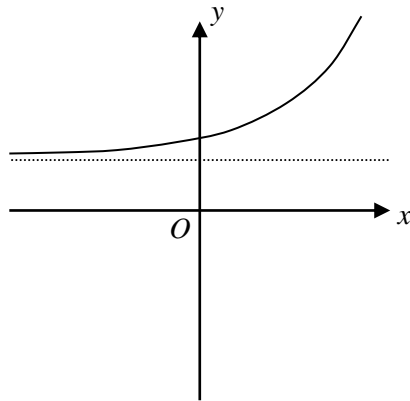
**C**  $x = 3$

**D**  $x = 4$

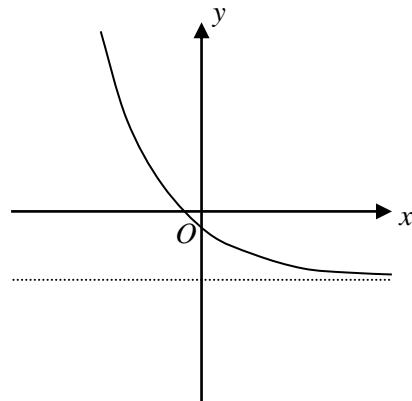
**E**  $x = \frac{1}{6}$

- 8 Which of the following graphs could be the graph of the function  $f(x) = 2^{ax} + b$ , where  $a$  and  $b$  are negative?

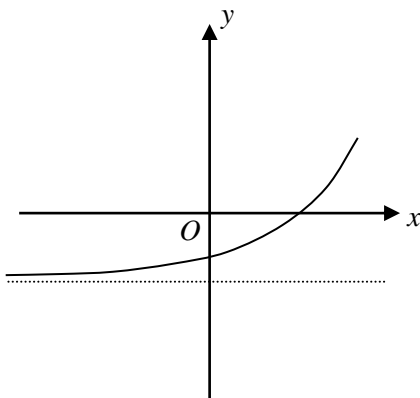
A



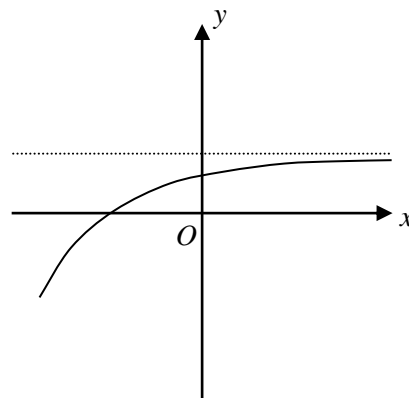
B



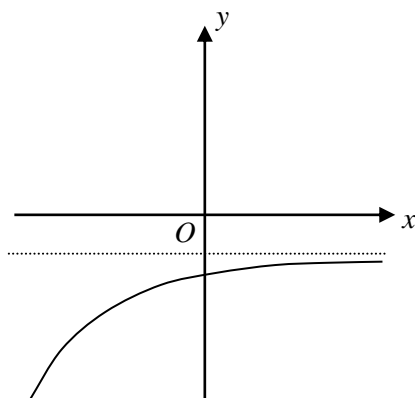
C



D



E



- 9 Which one of the following functions has a graph with a vertical asymptote with equation  $x = -b$ ?
- A  $y = \log_2(x + b)$
- B  $y = \frac{1}{x - b}$
- C  $y = \frac{1}{x - b} - b$
- D  $y = 2^x - b$
- E  $y = 2^{(x - b)}$
- 10 If  $\log_a(x^2) - 4 = 2 \log_a 6$ , where  $a > 0$  and  $x > 0$ , then
- A  $x = a^6$
- B  $x = 2 \log_a 6 + 4$
- C  $x = \frac{6}{a}$
- D  $x = \frac{a}{6}$
- E  $x = 6a^2$
- 11 If  $\log_{10}(x + 2) - \log_{10}(x - 2) = 2$  then
- A  $x = 98$
- B  $x = 2^{10} - 5$
- C  $x = 8$
- D  $x = 10$
- E  $x = \frac{202}{99}$
- 12 If  $\log_b a = 5$ , which of the following statements is always true?
- A  $a = 5^b$
- B  $a = b^5$
- C  $b = a^5$
- D  $b = a^5$
- E  $a = 5$

13 The function  $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = 2 \times 3^{\frac{x}{2}} - 1$  has range

- A  $\mathbb{R}$
- B  $\mathbb{R} \setminus \{-1\}$
- C  $(-1, \infty)$
- D  $(1, \infty)$
- E  $[1, \infty)$

14 If  $\log_3(3x + 2) = -1$  then:

- A  $x = 2$
- B  $x = \frac{-5}{9}$
- C  $x = -1$
- D  $x = \frac{-5}{3}$
- E  $x = \frac{2}{5}$

15 The solution of the equation  $3 \times 2^{5x} = 6$ , is

- A  $x = \frac{1}{2}$
- B  $x = \frac{1}{5}$
- C  $x = \frac{1}{5} \log_2 10$
- D  $x = \frac{1}{2} \log_2 5$
- E  $x = \frac{1}{5} 2^5$

## Short-answer questions (technology-free)

1 Solve the following equations for  $x$ :

- a  $3^x = 27$
- b  $3^{2x} - 10 \times 3^x + 9 = 0$
- c  $\log_{10}(x) + 2 \log_{10}(3) = \log_{10}(12)$
- d  $\log_2(x + a) = b$
- e  $2 \log_2(x) + \log_2(a) = 0$

**2** Sketch the following graphs clearly showing intercepts and asymptotes:

**a**  $y = 2^x - 1$

**b**  $y = 2 \log_{10}(3x)$

**c**  $y = \log_{10}(3 - 2x)$

**3** Simplify the following:

**a**  $\frac{8a^6}{6a^3} \div \frac{4(a^2)^4}{(3a)^3}$

**b**  $\frac{(3a^3)}{6a^{-1}}$

**4** Simplify the expression  $\log_2 12 + \log_2 10 - \log_2 15$ .

**5** If  $3 + \log_2(4x) = \log_2(y)$ , find  $y$  in terms of  $x$ .

**6** Find the set of values of  $t$  for which  $4 \times 2^{0.2t} > 2$ .

## Extended-response question

The size of a population of rabbits is determined by the rule  $P = 6400 \times 3^{0.2t} - 400$ , where  $P$  is the size of the population  $t$  years after January 2006.

**a** Find the size of the population when:

**i**  $t = 0$

**ii**  $t = 10$

**b** After how many years does the size of the population exceed 1 000 000?

**c** Sketch the graph of  $P$  against  $t$ .