PART 1 - Machine Scored

Answers are on the back page

1. An exponential function is given by $f(x) = a(2)^x - 5$, where $a \in I$, $a < 0$. The domain of the inverse function is:

A. $x \in R$ B. $x > -5$ C. $x < -5$ D. $x < 5$

2. The equation $log_{b+1}(3m) = \frac{1}{2}$, can be written in terms of b as:

A. $9m^2 - 1$ B. $3m^2 - 1$ C. $(3m - 1)^2$ D. $(9m - 1)^2$

Use the following information to answer the next question.

The y-intercept and asymptote of $\boldsymbol{f(x) = ab^x + d}$ (a, b and $\in I, b > 1$) can be expressed using the indicated codes.

Use the following codes (in bold) to complete the sentence below:

1 a **2** d **3** $b + d$ **4** $a + d$ **5** $ab + d$ **6** x **7** y

NR #1

The y-intercept of $f(x)$ is $y =$ ______ .
first code

$f(x)$ has an asymptote that can be written in the form ______ = ______ .
second code *third code*

Use the following information to answer the next two questions.

A function is defined by $f(x) = log_b(ax + b)$, where b and a are integers, $a > 0$ and $b \geq 2$.

3. The domain of $f(x)$ can be expressed as:

A. $x > -\frac{b}{a}$ B. $x > -b$ C. $x > -\frac{a}{b}$ D. $x > -a$

4. The y-intercept of $f(x)$ can be expressed as:

A. $log_b(a + b)$ B. $log_b(a)$ C. 1 D. 0

5. A student used an algebraic process to solve the equation $\frac{3^{x^2 + x}}{27^{3x - 1}} = 3\left(\frac{1}{9}\right)^{x - 2}$. He is able to simplify the equation to $x^2 + bx + c = 0$, where $b, c \in I$

The value of c is:

A. -8 B. -4 C. -2 D. -1

6. If $2a^b = c$ then an expression for b is:

A. $log_c\left(\frac{a}{2}\right)$ B. $log_{2a}c$ C. $log_c(2a)$ D. $log_a\left(\frac{c}{2}\right)$

Use the following information to answer the next question.

The following statements are made of a function $f(x) = a(2^{x-1}) + d$, where a, and d are integers, $a > 0$:

Statement 1: The y-intercept of the function is $\frac{a}{2} + d$

Statement 2: There is an asymptote at $x = 1$

Statement 3: There is an asymptote at $y = d$

Statement 4: There can never be an x-intercept

Statement 5: There is an x-intercept when $d < 0$

Statement 6: The inverse function will have a domain $x \in R$

NR #2

The true statements are ____, _____, and _____.

Write in any order

7. According to the federal census, the population of Calgary in 1971 was 403 319, and by 2016 had grown to 1 239 220. The approximate average annual growth rate over that period is:

A. 1.03%

B. 2.5%

C. 3.1%

D. 6.8%

8. A particular drug is administered to a patient so that the initial plasma level is 3600 mg/L. Exactly one day later the level was 1160 mg/L.

The approximate half-life for this drug is:

A. 11.3 hours

B. 14.7 hours

C. 25.5 hours

D. 39.2 hours

9. Exactly two years ago Harry invested $1000 into a GIC, which in that time has grown to $1127.84. Harry made his investment with the goal to double his money to $2000.

Assuming his rate of return stays the same, and he can withdraw at any point, the number of **additional** years Harry must wait, correct to the nearest tenth, is:

A. 5.8 years

B. 9.2 years

C. 11.5 years

D. 9.5 years

NR #3

If $log_a(8) = 2b - 1$ and $log_2 a = b,$ the largest positive value of b, correct to the nearest tenth is ______.

10. If $log_5 a = b + 2log_5 c$, then a is equal to :

A. $\frac{25}{b^c}$

B. $5^b c^2$

C. bc^2

D. $\frac{5^c}{b^2}$

NR #4

An equation $log_{x+1}(2x + 10) = 2$ has ____ real solution(s), the largest of which is $x =$ _____.

First digit of your answer *Second digit of your answer*

11. If $log_8 m = \frac{2}{3}$ and $3(2^n) = 5$, determine the value of $log_m n^m$, correct to the nearest hundredth:

A. -0.31 B. 0.31 C. -0.88 D. 0.78

12. $log_3 5 = a$ and $log_3 2 = b$ then an expression for $log_3 360$ is:

A. $6ab$ B. $2ab^3$ C. $a + b^3 + 2$ D. $a + 3b + 2$

NR #5 The equation $2^{3m-1} = 5^m$ has an exact solution that can be written in the form: $m = \dfrac{1}{a - log_2 c}$

The values of a and c are, respectively, _______.

13. If $\frac{1}{2}log_2 4m = log_2 n + 2log_2 p$ then m can be expressed as:

A. $\dfrac{n^2p^4}{4}$ B. $\dfrac{n^2p^4}{2}$ C. $\dfrac{(n+2p)^2}{4}$ D. $\dfrac{(n+2p)^2}{2}$

NR #6 The equation $log_5 x - log_5(x-1) = 3$ can be simplified to $ax - b = 0$, where a, b are positive integers. The value of a is ______.

14. The expression $2log4A - (3log2 - 6log\sqrt{A})$ can be simplified to:

A. $log\left(\dfrac{A^5}{2}\right)$ B. $log\,(2A^5)$ C. $log\left(\dfrac{2}{A}\right)$ D. $log\,(2A^8)$

NR #7 In June 1946 an earthquake in Vancouver Island measured 7.3 on the Richter Scale. Later that year an earthquake measured on the Queen Charlotte fault had one-quarter the intensity. The Richter scale value of the Queen Charlotte fault earthquake, correct to the nearest tenth, was ______.

15. If $log_m n = 5$, then the value of $log_m(\sqrt[4]{n^3}m^2)$, correct to the nearest tenth is:

A. 3.3 B. 3.8 C. 5.3 D. 5.8

16. The equation $log_3(x-3) + log_3(x-2) = 2$ can be simplified to $x^2 + bx + c$; $b, c \in I$, where c is equal to:

A. -3 B. 0 C. 4 D. 6

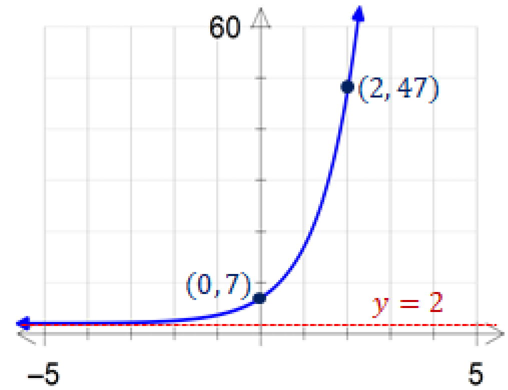
PART 2 – Written Response

Answers are on the back page

Use the following information to answer WR#1:

The graph on the right represents a function in the form $y = a(3)^x + k$.

The graph has a horizontal asymptote at $y = 2$.



❖ ***Written Response Question 1***

- Determine the values of a and k to derive the equation of the function. Show your reasoning. ***(2 marks)***

- Given a function $f(x) = 3(2)^x - 1$, determine the equation of the inverse function $g(x)$, and state the domain, range, and equation of the asymptote of $g(x)$. ***(3 marks)***

- BONUS *NOTE: An actual diploma exam question would never have a bonus component (sorry!)*

  Use an algebraic process to determine the exact value of any x or y intercepts for $g(x)$.

Use the following information to answer WR#2:

Strontium-90 is a radioactive isotope with applications in medicine and industry, and causes concern in fallout from nuclear weapons and accidents. Soil samples in particular area were tested for Strontium-90 over various years, and the results shown here:

Year	Millicuries (mCi) per square km
0 (initial)	1.220
5	1.082
10	0.959

❖ ***Written Response Question 2***

- Assuming an exponential rate of decay, algebraically determine the half-life for Strontium-90. *(correct to the nearest tenth of a year)* Use your result to construct an equation that models the amount of Stontium-90 in the soil, in mCi per square km, as a function of time in years after the initial sample was taken. ***(3 marks)***

- The amount of Iodine 131 in a sample after t days can be modeled by the equation $A = A_0(0.9172)^t$, where A_0 is the initial amount Iodine 131.

  Algebraically determine the minimum amount of time needed for a sample of Iodine 131 to decay to 10% of its initial amount. ***(2 marks)***

- BONUS *NOTE AGAIN: No actual bonus questions will be on your diploma exam!*

  Determine the half-life for Iodine 131 from the second bullet, to construct an alternative equation in the form $A = A_0(b)^{\frac{t}{p}}$, where A is the percentage of Iodine 131 remaining after t days.

Answers

For full, worked-out solutions (as well as other practice materials) visit **www.rtdmath.com**

Multiple Choice

1. C **2.** A **3.** A **4.** C **5.** C **6.** D **7.** B **8.** B **9.** D **10.** B **11.** C **12.** D
13. A **14.** B **15.** D **16.** A

Numerical Response

1. 472 or 427 **2.** 135 *any order* **3.** 1.5 **4.** 13 **5.** 35 **6.** 124 **7.** 6.7

Written Response

1. *First bullet* $y = 5(3)^x + 2 \quad a = 5 \quad k = 2$ *Second bullet* $y = log_2[\frac{1}{3}(x+1)]$ Domain: $x \geq -1$ Range: $y \in R$

Asymptote: $x = 1$ *(vertical)* *Third bullet (bonus)* $x = 2, \; y = log_2(\frac{1}{3})$

2. *First bullet* $y = 1.220(0.5)^{t/28.5}$ or $y = 1.220(0.976)^t$ NOTE: *Either form is ok!*

Second bullet 26.6 days *Third bullet (bonus)* $A = 100\left(\frac{1}{2}\right)^{t/8.02}$