

PART 1 - Machine Scored

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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 $f(x) = ab^x + d$ (a, b and $d \in I, b > 1$) can be expressed using the indicated codes.

Use the following codes (in bold) to complete the sentence below: www.rtdmath.com

- 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 $y = \underline{\hspace{2cm}}$.
first code

$f(x)$ has an asymptote that can be written in the form $\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$.
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 4: There can never be an x -intercept

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

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

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

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

NR #2

The true statements are _____, _____, and _____.

Write in any order

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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 $\log_5 a = b + 2\log_5 c$, 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: $m = \frac{1}{a - \log_2 c}$
- The values of a and c are, respectively, _____.

13. If $\frac{1}{2} \log_2 4m = \log_2 n + 2 \log_2 p$ then m can be expressed as:
- A. $\frac{n^2 p^4}{4}$ B. $\frac{n^2 p^4}{2}$ C. $\frac{(n+2p)^2}{4}$ D. $\frac{(n+2p)^2}{2}$

- 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 _____.
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14. The expression $2 \log 4A - (3 \log 2 - 6 \log \sqrt{A})$ can be simplified to:
- A. $\log \left(\frac{A^5}{2} \right)$ B. $\log (2A^5)$ C. $\log \left(\frac{2}{A} \right)$ 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

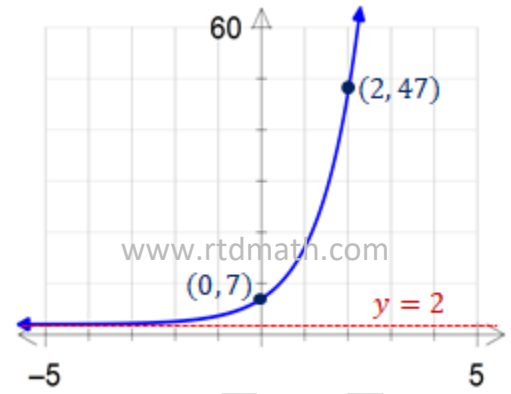
PART 2 - Written Response

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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 Strontium-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)

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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 $y = 5(3)^x + 2$ $a = 5$ $k = 2$ Second bullet $y = \log_2\left[\frac{1}{3}(x + 1)\right]$ Domain: $x \geq -1$ Range: $y \in R$
Asymptote: $x = 1$ (vertical) Third bullet (bonus) $x = 2$, $y = \log_2\left(\frac{1}{3}\right)$
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) $A = 100\left(\frac{1}{2}\right)^{t/8.02}$