Do not remove this answer page — you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of multiple choice and short answer questions. Record your answers on this page. For each multiple choice question, you will need to fill in the box corresponding to the correct answer. For example, if (a) is correct, you must write

| a | b | c | d | e |

Do not circle answers on this page, but please do circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

GOOD LUCK!

1.　a　b　**c**　d　e　　　　　10.　**a**　b　c　d　e

2.　a　**b**　c　d　e　　　　　11.　**a**　b　c　d　e

3.　a　**b**　c　d　e　　　　　12.　a　b　**c**　d　e

4.　a　b　**c**　d　e　　　　　13.　a　**b**　c　d　e

5.　a　b　**c**　d　e　　　　　14.　$f^{-1}(x) = 2 + 5x$

6.　**a**　b　c　d　e　　　　　15.　$x = 121$

7.　a　**b**　c　d　e　　　　　16.　$1 - (x - 4)^2$

8.　**a**　b　c　d　e　　　　　17.　$\log_8(4096) = 4$

9.　a　**b**　c　d　e　　　　　18.　4

For grading use:

Total	
	(out of 90 pts)

Multiple Choice Questions
Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page of this exam
and in the corresponding questions that follow.

1. Which of the following functions are one-to-one?

$$f(x) = |x| \qquad g(x) = x^3 \qquad h(x) = 2x^2 + 4x$$

   Possibilities:

   (a) Only $h(x)$ is one-to-one.
   (b) Only $f(x)$ and $h(x)$ are one-to-one.
   (c) Only $g(x)$ is one-to-one.
   (d) Only $f(x)$ and $g(x)$ are one-to-one.
   (e) Only $f(x)$ is one-to-one.

2. Let $f(x) = |x - 3|$. Find the average rate of change of $f(x)$ between $x = 1$ and $x = 9$.

   Possibilities:

   (a) $\dfrac{-1}{2}$
   (b) $\dfrac{1}{2}$
   (c) 2
   (d) 4
   (e) 1

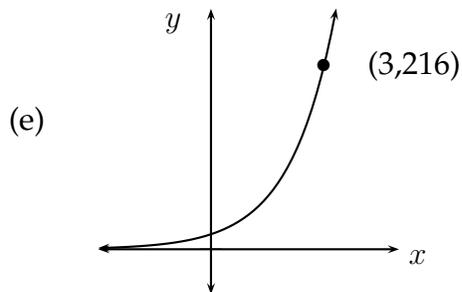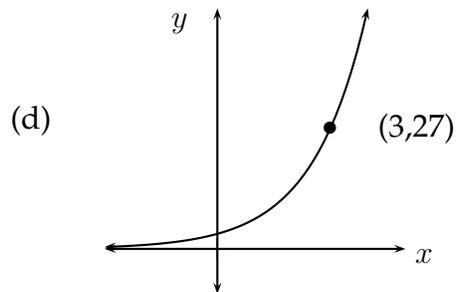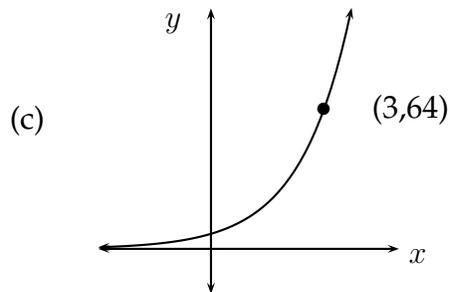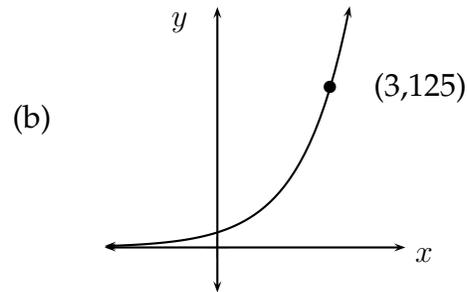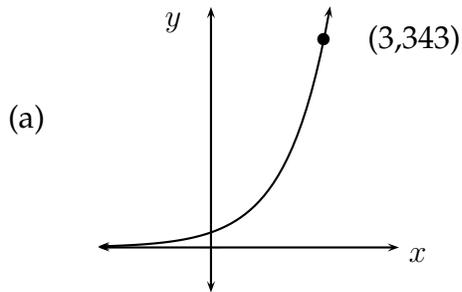3. Let $f(x) = \sqrt{x - 5}$ and $g(x) = x + 1$. Find $(f - g)(9)$.

   Possibilities:

   (a) -4
   (b) -8
   (c) -6
   (d) -10
   (e) 8

4. Which of the following is the graph of $y = 4^x$?

Possibilities:

(a)

(3,343)

(b)

(3,125)

(c)

(3,64)

(d)

(3,27)

(e)

(3,216)

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5. Let $f(x) = 4 - 2x^2$. Find $\dfrac{f(x+h) - f(x)}{h}$.

Possibilities:

(a) 1

(b) $\dfrac{-4x^2 - 4xh - 2h^2}{h}$

(c) $-4x - 2h$

(d) $4x + 2h$

(e) $\dfrac{8 - 4x^2 - 4xh - 2h^2}{h}$

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6. Suppose $(-4, 6)$ lies on the graph of $y = f(x)$. Find a point on the graph of $y = g(x)$ if $g(x) = f(2x) - 3$.

Possibilities:

(a) $(-2, 3)$
(b) $(-2, 9)$
(c) $(-1, 12)$
(d) $(-8, 3)$
(e) $(-7, 3)$

7. Use a calculator to approximate $\log_{13}(15)$. Your answer should be correct to 5 decimal places.

Possibilities:

(a) 1.15385
(b) 1.05579
(c) 1.17609
(d) 1.76611
(e) 2.56495

8. Use the laws of logarithms to write the expression as a single logarithm.

$$3 \log(x) + 5 \log(x) - \log(6x - 8)$$

Possibilities:

(a) $\log \left(\dfrac{x^8}{6x - 8} \right)$

(b) $\log \left(x^3 + x^5 + 6x - 8 \right)$

(c) $\log \left(\dfrac{x^8}{-6x + 8} \right)$

(d) $\log \left(\dfrac{8x}{6x - 8} \right)$

(e) $\log \left(\dfrac{x^{15}}{6x - 8} \right)$

9. Carol invests $4000 at an interest rate of 8% per year compounded weekly. Find the amount of the investment at the end of 13 years. Round your answer to the nearest cent. (**HINT:** There are 52 weeks in one year.)

   Possibilities:

   (a) $4332.88

   (b) $11307.83

   (c) $11383.19

   (d) $218824.16

   (e) $4080.74

10. The mass $m(t)$ remaining after t years from a 80-gram sample of a radioactive element is given by $m(t) = 80e^{-0.2t}$. When will the mass remaining equal 8 grams? Round your answer to the nearest hundredth of a year.
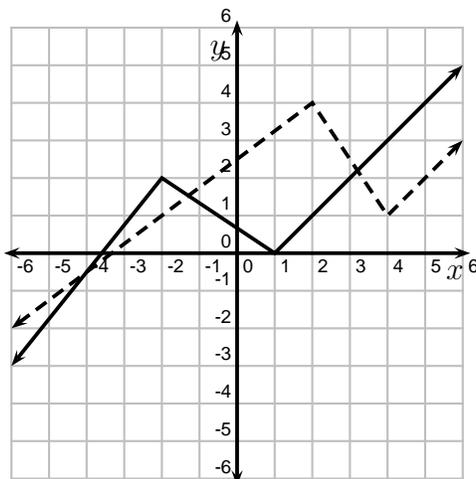
    Possibilities:

    (a) About 11.51 years

    (b) About 5.00 years

    (c) About 0.12 years

    (d) About 2.30 years

    (e) About 0.18 years

11. Find the domain and range of $f(x) = \ln(x - 6)$.

    Possibilities:

    (a) Domain: $(6, \infty)$ Range: $(-\infty, \infty)$

    (b) Domain: $(-\infty, \infty)$ Range: $(-\infty, \infty)$

    (c) Domain: $(-\infty, \infty)$ Range: $[6, \infty)$

    (d) Domain: $[6, \infty)$ Range: $(-\infty, \infty)$

    (e) Domain: $(-\infty, \infty)$ Range: $(6, \infty)$

12. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Use the graphs to evaluate $g(f(-2))$.

Possibilities:

(a) -4

(b) -2

(c) 4

(d) 3

(e) 1

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13. Explain how the graph of $g(x) = (x + 2)^3 - 10$ is obtained from the graph of $f(x) = x^3$.

Possibilities:

(a) Shift right 2 units and shift up 10 units.

(b) Shift left 2 units and shift down 10 units.

(c) Shift right 2 units and shift down 10 units.

(d) Shift left 10 units and shift down 2 units.

(e) Shift right 10 units and shift up 2 units.

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14. Find the inverse function of $f(x) = \dfrac{x-2}{5}$.

15. Solve for x.

$$\log_5(x+4) = 3$$

16. Let $f(x) = 1 - x^2$ and $g(x) = x - 4$. Find $f(g(x))$.

17. Express the equation in logarithmic form.

$$8^4 = 4096$$

18. Let $f(x) = 3^x$. Find the average rate of change of f with respect to x as x goes from 0 to 2.

Compound Interest: If a principal P_0 is invested at an interest rate r for a period of t years, then the amount $P(t)$ of the investment is given by:

$$P(t) = P_0 \left(1 + \frac{r}{n}\right)^{nt} \quad \text{(if compounded } n \text{ times per year)}$$

$$P(t) = P_0 \, e^{rt} \quad \text{(if compounded continuously).}$$

Change of Base Formula: Let a and b be two positive numbers with $a, b \neq 1$. If $x > 0$, then:

$$\log_b x = \frac{\log_a x}{\log_a b}$$