Notes:
1. *Answers, with limited or no work, can be found on the last page.*
2. *Links to video solutions to these questions can be found in the Test #3 Review page in Canvas.*
3. *The questions are numbered according to the corresponding questions in the Chapter 8 and Chapter 9 Tests at the end of each chapter in the eText.*
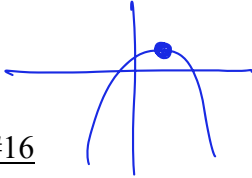
Sections 8.6-8.8 Questions

$a < 0$

Ch8 Test #16

Given the function $f(x) = 4(x-3)^2 + 5$ ⟵——— $a(x-h)^2 + k$

$\underbrace{\qquad}$ vertex is (h, k)

a. Graph the function
b. Label the vertex
c. Draw the axis of symmetry
d. Find the maximum or the minimum function value

Vertex $= (3, 5)$
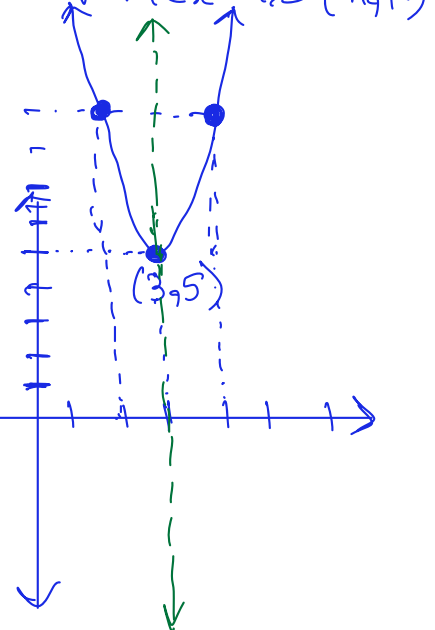
$x = 3$

5

min. value $= 5$

$(3, 5)$

Ch8 Test #17

For the function $f(x) = 2x^2 + 4x - 6$

$a = 2, b = 4, c = -6$

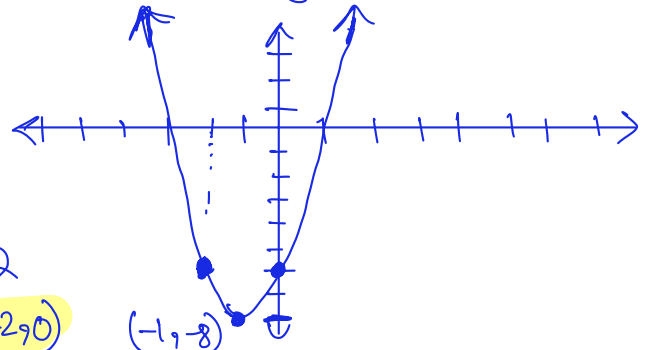a. Find the vertex and the axis of symmetry
b. Graph the function

$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right) \right)$ $\frac{-b}{2a} = \frac{-4}{2(2)} = \frac{-4}{4} = -1$

$f(-1) = 2(-1)^2 + 4(-1) - 6$
$= 2 - 4 - 6 = -8$

vertex $= (-1, -8)$

Axis of symm.: $x = -1$

Ch8 Test #18

Find the x and y intercepts of $f(x) = x^2 - x - 6$

y-int: $x = 0$, $f(0) = -6 \Rightarrow (0, -6)$

x-int: $y = 0$, $x^2 - x - 6 = 0$

$(x-3)(x+2) = 0 \Rightarrow x = 3, -2$

$\Rightarrow (3, 0), (-2, 0)$ $(-1, -8)$

Ch8 Test #21

Jay's Metals has determined that when x hundred storage cabinets are built, the average cost per cabinet is given by the function $C(x) = 0.2x^2 - 1.3x + 3.4025$, where $C(x)$ is in hundreds of dollars. What is the minimum cost per cabinet and how many cabinets should be built in order to achieve that minimum?

Ch9 Test #1

Find $(f \circ g)(x)$ and $(g \circ f)(x)$ if $f(x) = x + x^2$ and $g(x) = 2x + 1$

$(f \circ g)(x) = f(g(x)) = f(2x+1) = (2x+1) + (2x+1)^2$

$= 2x+1 + (2x)^2 + 1^2 + 2(2x)(1) = 2x+1 + 4x^2 + 1 + 4x$

$= 4x^2 + 6x + 2$.

$(g \circ f)(x) = g(f(x)) = g(x+x^2)$

$= 2(x+x^2) + 1 = 2x^2 + 2x + 1$

Ch9 Test #4

Find the formula for the inverse. $f(x) = 3x + 4$

$y = 3x+4$ interchange x and y

$x = 3y+4 \Rightarrow x-4 = 3y \Rightarrow \frac{x-4}{3} = y \Rightarrow y = \frac{1}{3}x - \frac{4}{3}$

$\Rightarrow f^{-1}(x) = \frac{1}{3}x - \frac{4}{3}$

Ch9 Test #5

Find the formula for the inverse. $g(x) = (x+1)^3$

$y = (x+1)^3$ interchange x and y

$x = (y+1)^3 \Rightarrow \sqrt[3]{x} = y+1 \Rightarrow \sqrt[3]{x} - 1 = y \Rightarrow f^{-1}(x) = \sqrt[3]{x} - 1$

Ch9 Test #6

Graph $f(x) = 2^x - 3$

Ch9 Test #7

$g(1) = 0$
$g(7) = 1$
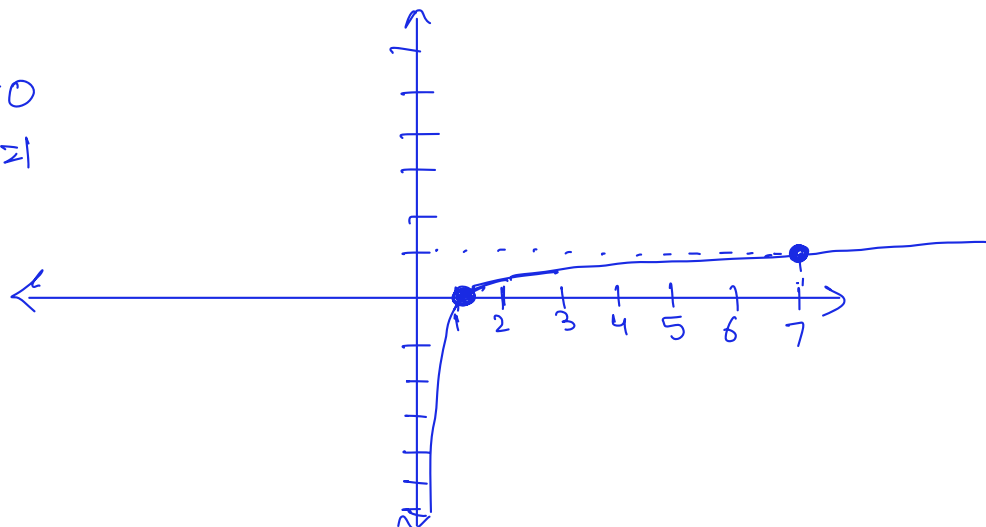
Graph $g(x) = \log_7 x$

$\log_7 1 = 0 \quad (1, 0)$
$\log_7 7 = 1 \quad (7, 1)$

Ch9 Test #8

Simplify $\log_5 125$

$\log_5 125 = \log_5 5^3 = 3$

$125 = 5^m \Rightarrow 125 = 5^3$

$$\log_b a = \frac{\log_c a}{\log_c b}$$

Ch9 Test #9

Simplify $\log_{100} 10$

$$= \frac{\log_{10} 10^1}{\log_{10} 100} = \frac{1}{\log_{10} 10^2} = \frac{1}{2}$$

Ch9 Test #10

Simplify $\log_n n \quad = \log_n n^1$

$$= 1$$

Ch9 Test #11

Simplify $\log_c 1 \quad = \log_c c^0$

$$= 0$$

Ch9 Test #14

Express as an equivalent expression using the individual logarithms of a, b, and c:

$$\log \frac{a^3 b^{\frac{1}{2}}}{c^2}$$

$$\log \frac{a^3 b^{\frac{1}{2}}}{c^2} = \log a^3 b^{\frac{1}{2}} - \log c^2 = \log a^3 + \log b^{\frac{1}{2}} - \log c^2$$

$$= 3\log a + \frac{1}{2}\log b - 2\log c$$

Ch9 Test #15

Express as an equivalent expression that is a single logarithm:

$$\frac{1}{3}\log_a x + 2\log_a z$$

$$\frac{1}{3}\log_a x + 2\log_a z = \log_a x^{\frac{1}{3}} + \log_a z^2 = \log_a x^{\frac{1}{3}} z^2$$

$$= \log_a \sqrt[3]{x}\, z^2$$

Ch9 Test #19

Use your calculator to evaluate to four decimal places: $\log 25$

Ch9 Test #21

Use your calculator to evaluate to four decimal places: $\ln 0.4$

Ch9 Test #22

Use your calculator to evaluate to four decimal places: $e^{4.8}$

Ch9 Test #23

Find $\log_3 14$ using the change-of-base formula. Round to four decimal places.

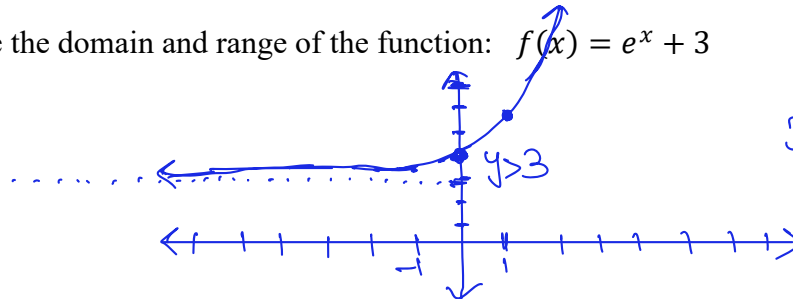$$\log_b a = \frac{\log_c a}{\log_c b}$$

$$= \frac{\log 14}{\log 3} = 2.4022 \qquad\Rightarrow\qquad \frac{\ln 14}{\ln 3} = 2.4022$$

Ch9 Test #24

Graph and state the domain and range of the function: $f(x) = e^x + 3$

$f(0) = 4$
$f(-1) = e^{-1} + 3 = 3.36$
$f(1) = e^1 + 3 = 5.7$

$y > 3$

Domain $= (-\infty, \infty)$
Range $= (3, \infty)$

Ch9 Test #25

Graph and state the domain and range of the function: $g(x) = \ln(x - 4)$

$x - 4 > 0 \Rightarrow x > 4$

$x = 5 \Rightarrow g(5) = \ln(5-4) = \ln 1 = 0$
$x = 6 \Rightarrow g(6) = \ln(6-4) = \ln 2 = 0.693$

Domain $= (4, \infty)$
Range $= (-\infty, \infty)$
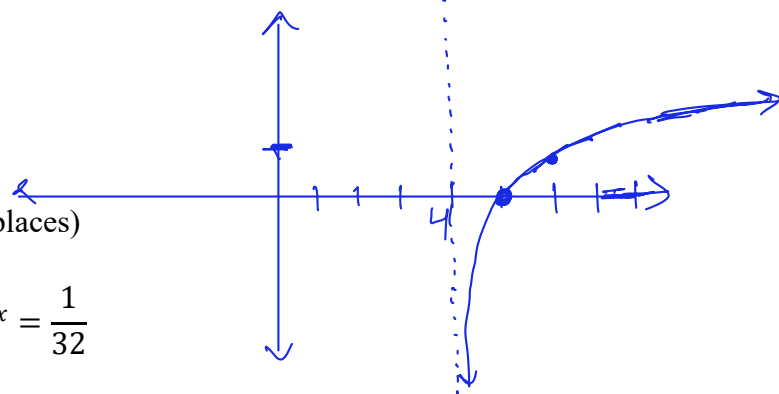

Ch9 Test #26

Solve (if necessary, approximate to four decimal places)

$$2^x = \frac{1}{32}$$

$$2^x = \frac{1}{32} \Rightarrow 2^x = \frac{1}{2^5} \Rightarrow 2^x = 2^{-5}$$

$$\Rightarrow x = -5$$

$32 = 2^5$

4

Ch9 Test #27

Solve (if necessary, approximate to four decimal places)

$$\log_4 x = \frac{1}{2}$$

$$x = 4^{1/2} \Rightarrow x = \left(2^2\right)^{1/2} = 2^{2 \times \frac{1}{2}}$$
$$\Rightarrow x = 2$$

Ch9 Test #28

Solve (if necessary, approximate to four decimal places)

$$\log x = -2$$

$$\log_{10} x = -2 \Rightarrow x = 10^{-2}$$
$$\Rightarrow x = \frac{1}{10^2} = \frac{1}{100} \Rightarrow x = 0.001$$

Ch9 Test #29

Solve (if necessary, approximate to four decimal places)

$$7^x = 1.2$$

$$\log 7^x = \log 1.2 \Rightarrow x \log 7 = \log 1.2$$
$$\Rightarrow x = \frac{\log 1.2}{\log 7} = 0.09$$

Ch9 Test #32

The population of Nigeria was about 186 million in 2016, with the exponential growth rate of 2.6% per year.

a. Write an exponential function describing the population of Nigeria.
b. What will the population be in 2020? In 2050?
c. When will the population reach 500 million?
d. What is the doubling time?

Ch9 Test #34

annually.

An investment with interest compounded ~~continuously~~ doubled itself in 16 years. What was the interest rate?

$$A(t) = P(1+r)^t \Rightarrow A(16) = 2P$$
$$\Rightarrow P(1+r)^{16} = 2P \Rightarrow (1+r)^{16} = 2$$

$$\log(1+r)^{16} = \log 2 \implies 16 \log(1+r) = \log 2$$

$$\implies \log(1+r) = \frac{\log 2}{16} = 0.0188$$

$$\implies \log(1+r) = 0.0188$$

$$\implies 1+r = 10^{0.0188} \implies 1+r = 1.044$$

$$\implies r = 0.044 \implies r = 4.4\%$$