Graph the quadratic function. Specify the vertex, axis of symmetry, maximum or minimum value, and intercepts.

\[ y = x^2 + 6x - 6 \]

a. vertex: \((-3, -3)\); axis of symmetry: \(x = -3\); maximum value: \(-3\); \(x\)-intercepts: \(-3 \pm \sqrt{3}\); \(y\)-intercept: -12.

b. vertex: \((-3, -9)\); axis of symmetry: \(x = -3\); minimum value: \(-9\); \(x\)-intercepts: \(-3 \pm \sqrt{15}\); \(y\)-intercept: 0.

c. vertex: \((-3, -15)\); axis of symmetry: \(x = -3\); maximum value: \(-15\); \(x\)-intercepts: \(-3 \pm \sqrt{15}\); \(y\)-intercept: -24.
d. vertex: (-3, -15); axis of symmetry: \(x = -3\); minimum value: -15; x-intercepts: \(-3 \pm \sqrt{15}\); y-intercept: -6.

![Graph of a parabola with vertex at (-3, -15).]

e. vertex: (3, -15); axis of symmetry: \(x = 3\); minimum value: -15; x-intercepts: \(3 \pm \sqrt{15}\); y-intercept: -6.

![Graph of a parabola with vertex at (3, -15).]

---

2 Two numbers add to 7. What is the largest possible value of their product?

a. 12  
b. \(\frac{41}{2}\)  
c. \(\frac{49}{3}\)  
d. \(\frac{49}{4}\)  
e. 7

3 Find two numbers adding to 20 such that the sum of their squares is as small as possible.

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<td>(n_1 = 3, n_2 = 17)</td>
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4. What is the largest possible area for a rectangle with a perimeter of 40 cm?

a. 400 cm$^2$

b. 100 cm$^2$

c. 70 cm$^2$

d. 150 cm$^2$

e. 110 cm$^2$

5. Suppose that the function $p = -\frac{1}{4}x + 40$ relates the selling price $p$ of an item to the number of units $x$ that are sold. Assume that $p$ is in dollars. What is this maximum revenue?

a. $1600$

b. $1800$

c. $3200$

d. $1300$

e. $1500$

6. Sketch the graph of the function and specify all $x$- and $y$-intercepts.

$y = (x - 3)^3 - 5$

a. $x$-intercept: 3

$y$-intercept: -27
b. 
\[x\text{-intercept: } -3 - \frac{3}{\sqrt{5}}\]
\[y\text{-intercept: } -32\]

c. 
\[x\text{-intercept: } \frac{3}{\sqrt{5}} - 3\]
\[y\text{-intercept: } 22\]

d. 
\[x\text{-intercept: } 3 + \frac{3}{\sqrt{5}}\]
\[y\text{-intercept: } -32\]
Sketch the graph of the function and specify all $x$- and $y$-intercepts.

$y = (x - 4)(x - 3)(x + 3)$

**a.**
- $x$-intercepts: -3, 3, 4
- $y$-intercept: 36

**b.**
- $x$-intercepts: -4, 3, 4
- $y$-intercept: 48
Sketch the graph of the rational function. Specify the intercepts and the asymptotes.
\[ y = - \frac{1}{x + 3} \]

a. no \(x\)-intercepts; \(y\)-intercept: \(\frac{1}{3}\); vertical asymptote: \(x = 3\); horizontal asymptote: \(y = 0\);

![Graph of function with asymptotes and intercepts](image1)

b. no \(x\)-intercepts; \(y\)-intercept: \(\frac{1}{6}\); vertical asymptote: \(x = 6\); horizontal asymptote: \(y = 0\);

![Graph of function with asymptotes and intercepts](image2)
c. no $x$-intercepts; $y$-intercept: $-\frac{1}{3}$; vertical asymptote: $x = -3$; horizontal asymptote: $y = 0$;

d. no $x$-intercepts; $y$-intercept: $-\frac{1}{6}$; vertical asymptote: $x = -6$; horizontal asymptote: $y = 0$;

e. no $x$-intercepts; $y$-intercept: $\frac{1}{3}$; vertical asymptote: $x = -3$; horizontal asymptote: $y = 0$;
9 Sketch the graph of the rational function. Specify the intercepts and the asymptotes.

\[ y = \frac{x - 3}{x + 5} \]

a. x-intercept: 3; y-intercept: -1; vertical asymptote: x = 3; horizontal asymptote: y = -1;

b. x-intercept: 0; y-intercept: -1; vertical asymptote: x = 3; horizontal asymptote: y = -1;
c. $x$-intercept: -3; $y$-intercept: -1; vertical asymptote: $x = 3$; horizontal asymptote: $y = 1$;

\[ \text{Sketch the graph of the rational function. Specify the intercepts and the asymptotes.} \]
\[ y = -\frac{1}{(x + 2)^3} \]

a. no \( x \)-intercepts; \( y \)-intercept: \( -\frac{1}{8} \); vertical asymptote: \( x = -2 \); horizontal asymptote: \( y = 0 \);

b. no \( x \)-intercepts; \( y \)-intercept: \( -\frac{1}{4} \); vertical asymptote: \( x = -2 \); horizontal asymptote: \( y = 0 \);
c. no x-intercepts; y-intercept: \( \frac{1}{4} \); vertical asymptote: \( x = 2 \);
horizontal asymptote: \( y = 0 \);

\[ \text{Diagram} \]

d. no x-intercepts; y-intercept: \( \frac{1}{8} \); vertical asymptote: \( x = 2 \);
horizontal asymptote: \( y = 0 \);

\[ \text{Diagram} \]

e. no x-intercepts; y-intercept: \( \frac{1}{8} \); vertical asymptote: \( x = -2 \);
horizontal asymptote: \( y = 0 \);

\[ \text{Diagram} \]
Sketch the graph of the rational function. Specify the intercepts and the asymptotes.

\[ y = \frac{x}{(x + 3)(x - 4)} \]

a. \( x \)-intercept: 0; \( y \)-intercept: 0; vertical asymptotes: \( x = -4, x = 3 \); horizontal asymptote: \( y = 0 \);

b. \( x \)-intercept: 0; \( y \)-intercept: 0; vertical asymptotes: \( x = -4, x = 3 \); horizontal asymptote: \( y = 0 \);
c. $x$-intercept: 0; $y$-intercept: 0; vertical asymptotes: $x = -3$, $x = 4$; horizontal asymptote: $y = 0$.

![Graph](image1)

d. $x$-intercept: 0; $y$-intercept: 0; vertical asymptotes: $x = -3$, $x = 4$; horizontal asymptote: $y = 0$.

![Graph](image2)

e. $x$-intercept: 0; $y$-intercept: 0; vertical asymptotes: $x = -4$, $x = 3$; horizontal asymptote: $y = 0$.

![Graph](image3)
Use properties of exponents to simplify.

\[ \left(3^1 + \sqrt[3]{5}\right)\left(3^1 - \sqrt[3]{5}\right) \]

\begin{align*}
64 & \quad 16 & \quad 9 & \quad 3\sqrt[5]{5} & \quad 512 \\
\text{a.} & \quad \text{b.} & \quad \text{c.} & \quad \text{d.} & \quad \text{e.}
\end{align*}

Solve the equation.

\[ 3^y - 2^y = \sqrt{3} \]

\begin{align*}
& \quad y = \frac{1}{4} \\
& \quad y = \frac{7}{4} \\
& \quad y = \frac{11}{4} \\
& \quad y = \frac{3}{4} \\
& \quad \text{no solution}
\end{align*}

d. \quad y = \frac{3}{4}

e. \quad \text{no solution}

Graph the pair of functions on the same set of axes.

\[ y = \left(\frac{1}{3}\right)^x; \quad y = 3^x \]

\[ y = \left(\frac{1}{3}\right)^x \]

\[ y = 3^x \]
15. Graph the function and specify the asymptote.

\[ y = 4^x + 1 \]

a. 

\[ y = \frac{3}{4} \]

b. 

\[ y = -1 \]
c. 

asympotote: \( y = 4 \)

d. 

asympotote: \( y = 1 \)

e. 

asympotote: \( y = -3 \)
16. Solve for $x$.

$$6x(10^x) + 10^x = 0$$

a. $x = -\frac{1}{6}, 0$

b. $x = -1, -\frac{1}{2}$

c. $x = -\frac{1}{6}$

d. $x = 0, -1, -\frac{1}{6}$

e. no solution

17. Graph the function.

$$y = 6^{x+1} + 3$$

a. [Graph image]

b. [Graph image]
Graph the function and specify the domain, range, intercept(s), and asymptote.

\[ y = \log_2 x \]
a.

domain: (1, ∞)
range: (−∞, ∞)
x-intercept: −2
y-intercept: none
asymptote: x = -1

b.

domain: (0, ∞)
range: (−∞, ∞)
x-intercept: 1
y-intercept: none
asymptote: x = 0
c. 

\[
\begin{aligned}
\text{domain: } & (-\infty, 0) \\
\text{range: } & (-\infty, \infty) \\
x\text{-intercept: } & -1 \\
y\text{-intercept: none} \\
asymptote: & \quad x = 0
\end{aligned}
\]


d. 

\[
\begin{aligned}
\text{domain: } & (0, \infty) \\
\text{range: } & (-\infty, \infty) \\
x\text{-intercept: } & 1 \\
y\text{-intercept: none} \\
asymptote: & \quad x = 0
\end{aligned}
\]
Simplify the expression.

\[ \ln e^8 \]

\[
\begin{align*}
a. & \quad 8 \\
b. & \quad \frac{1}{8} \\
c. & \quad 1 \\
d. & \quad -8 \\
e. & \quad -\frac{1}{8}
\end{align*}
\]

Simplify the expression by using the definition and properties of logarithms.

\[ \log_{10} 600 - \log_{10} 6 \]

\[
\begin{align*}
a. & \quad 6 \\
b. & \quad 594 \\
c. & \quad 1 \\
d. & \quad 100 \\
e. & \quad 2
\end{align*}
\]

Simplify the expression by using the definition and properties of logarithms.

\[ \log_{10} 1.20 + \log_{10} \left( \frac{5}{6} \right) \]

\[
\begin{align*}
a. & \quad 1 \\
b. & \quad 5 \\
c. & \quad 1.2 \\
d. & \quad 2 \\
e. & \quad 4
\end{align*}
\]
Simplify the expression by using the definition and properties of logarithms.

\[ \ln e^5 - \ln e \]

\[ \frac{4}{e^4} \quad \frac{e^4}{e^5} \quad \frac{e}{e^5} \quad 6 \quad \frac{1}{e} \]

Write the quantity using sums and differences of simpler logarithmic expressions. Express the answer so that logarithms of products, quotients, and powers do not appear.

\[ \ln \frac{x^6}{\sqrt{1 + x^8}} \]

\[ 8 \ln x - \frac{1}{5} \ln (1 + x^6) \]

\[ \frac{40 \ln x}{\ln (1 + x^6)} \]

\[ 8 \ln x + 8 \ln (1 + x) \]

\[ 8 \ln x - 5 \ln (1 + x^6) \]

\[ 40 \ln x + 5 \ln (1 + x^6) \]

Solve the equation. Express the answer in terms of natural logarithms.

\[ 2 = 3e^{3x - 2} \]

\[ x = \ln 2 - \ln 3 + 2 \]

\[ x = \frac{\ln 3 + \ln 2 + 2}{6} \]

\[ x = \frac{\ln 2 - \ln 3 + 2}{3} \]

\[ x = \left( \frac{\ln 2}{3} + 2 \right) + 3 \]

\[ x = \ln 3 + \ln 2 + 2 \]
Express the quantity in terms of natural logarithms.

\[ \log_{10} 3 \]

\[ \frac{\ln 3}{\ln 10} \quad \frac{(\ln 3)(\ln 10)}{\ln 10} \quad \frac{\ln 3}{\ln 10} \]

Find all the real-number roots of the equation. Give an exact expression for the root and also (where appropriate) a calculator approximation rounded to three decimal places.

\[ 2^x = 5^{6x - 1} \]

\[ x = \frac{\ln 5}{6\ln 5 - \ln 2} \approx 0.180 \]

\[ x = \frac{\ln 2}{6\ln 2 - \ln 5} \approx 0.322 \]

\[ x = \frac{\ln 5 - \ln 2}{\ln 5} \approx 5.569 \]

\[ x = \frac{1}{6 - \log_5 2} \approx 0.322 \]

\[ x = \frac{1}{6 - \log_2 5} \approx 0.180 \]
Find all the real-number roots of the equation. Give an exact expression for the root and also (where appropriate) a calculator approximation rounded to three decimal places.

\[ \log_b x + \log_b (x + 9) = 0 \]

a. \[ x = \frac{-9 - \sqrt{85}}{2} \approx -9.110 \]

b. \[ x = \frac{9 - \sqrt{85}}{2} \approx 0.253 \]

c. \[ x = \frac{-9 + \sqrt{85}}{2} \approx 0.110 \]

d. \[ x = \frac{9 + \sqrt{85}}{2} \approx 0.253 \]

e. no solution

Find all the real-number roots of the equation. Give an exact expression for the root and also (where appropriate) a calculator approximation rounded to three decimal places.

\[ \log_{10} (x + 5) - \log_{10} (x - 7) = 2 \]

a. \[ x = \frac{7 - \sqrt{117}}{2} \approx -7.121 \]

b. \[ x = \frac{7 \frac{12}{99}}{} \approx 7.277 \]

c. \[ x = \frac{5 \frac{12}{99}}{} \approx 7.277 \]

d. \[ x = \frac{235}{33} \approx 7.121 \]

e. no solution
Solve the inequality.

30 \(9 \left(5 - \left(\frac{9}{44}\right)^x\right) \leq 1\)

\((-\infty, -1]\) \hspace{1cm} (-1, -1] \hspace{1cm} (-\infty, -1]

a. \([-1, +\infty)\] \hspace{1cm} b. \((-1, +\infty)\) \\

c. \\

d. \\

e.

31 \(\log_2 \frac{12x - \frac{1}{6}}{x - 6} < 0\)

a. \(\left(\frac{1}{12}, 6\right)\)

b. \([-\frac{5}{12}, \frac{1}{12})\)

c. \(\left(\frac{1}{12}, 6\right]\)

d. \(-\frac{5}{12}, \frac{1}{12}\) \\
e. \(-\infty, \frac{1}{12}\) U \([6, +\infty)\)
Solve the inequality.

\[ \ln \frac{4x - 7}{5x + 1} > \ln 3 \]

a. \( \left( -\frac{1}{5}, \frac{10}{11} \right) \)

b. \( \left[ -\frac{10}{11}, -\frac{1}{5} \right) \)

c. \( \left( -\infty, -\frac{1}{5} \right] \cup \left( \frac{10}{11}, +\infty \right) \)

d. \( \left( -\infty, -\frac{10}{11} \right) \cup \left( -\frac{1}{5}, +\infty \right) \)

e. \( \left( -\frac{10}{11}, -\frac{1}{5} \right) \)

You invest $500 at 10% interest compounded annually. How much is in the account after 4 years, assuming that you make no subsequent withdrawal or deposit?

a. $550  
b. $732.05  
c. $802.05  
d. $20500  
e. $73205

A bank pays 6% interest compounded annually. What principal will grow to $5500 in 10 years?

a. $3071.17  
b. $3061.17  
c. $6142.34  
d. $3139  
e. $3437.5

A sum of $3000 is placed in a savings account at 6% per annum. How much is in the account after 5 years if the interest is compounded quarterly?

a. $4030.57  
b. $9621.41  
c. $3720.00  
d. $4014.68  
e. $4040.57
You invest $500 at 6% per annum compounded quarterly. How long will it take for your balance to exceed $650? (Round your answer up to the next quarter.)

- 5 quarters
- 18 quarters
- 35 quarters
- 24 quarters
- 17 quarters

A bank offers an interest rate of 11% per annum compounded daily (assuming 365-day year). What is the effective rate?

- 12.73%
- 11.13%
- 6.81%
- 11.03%
- 11.63%

What principal should you deposit at 5 1/2% per annum compounded semiannually so as to have $7000 after 10 years?

- $4068.75
- $8136.51
- $4078.85
- $4566.75
- $4053.81

You place a sum of $500 in a savings account at 5% per annum compounded continuously. When will the balance reach $800?

- in 17.8 years
- in 9.46 years
- in 2.8 years
- in 8.2 years
- in 9.4 years

Given a nominal rate of 12% per annum, compute the effective rate under continuous compounding of interest.

- 12.75%
- 24.5%
- 15.45%
- 13.85%
- 2.71%
# ANSWER KEY

## PRACTICE EXERCISES FOR EXAM 3

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