CHAPTER 2: Polynomial and Rational Functions

(A) means “refer to Part A,” (B) means “refer to Part B,” etc. 
(Calculator) means “use a calculator.” Otherwise, do not use a calculator.

SECTION 2.1: QUADRATIC FUNCTIONS
(AND PARABOLAS)

1) The graph of the equation \( y = x^2 - 2x - 8 \) is a parabola. (A-D)
   a) Does the parabola open upward or downward?
   b) Find the vertex of the parabola.
   c) Find the axis of symmetry for the parabola.
   d) Find the \( y \)-intercept of the parabola.
   e) Find the \( x \)-intercept(s) of the parabola, if any.
   f) Use c) and d) to find another point on the parabola.
   g) Graph the parabola in the \( xy \)-plane.

2) Repeat Exercise 1, tasks a)-e) for the parabola with equation \( y = -6x^2 - 33x - 15 \). (Calculator) (A-D)

3) Repeat Exercise 1, tasks a)-e) for the parabola with equation \( y = x^2 - 4x + 7 \). (A-D)

4) The graph of the equation \( y = x^2 + 8x + 10 \) is a parabola. (E)
   a) Find the Standard Form (or Vertex Form) of the equation of the parabola.
   b) Does the parabola open upward or downward?
   c) Find the vertex of the parabola.

5) Repeat Exercise 4 for the parabola with equation \( y = -4x^2 + 24x - 37 \). (E)

6) Repeat Exercise 4 for the parabola with equation \( y = 2x^2 - 14x + 27 \). (E)

7) Find an equation for the parabola that has vertex \((6, -3)\) and that contains the point \((3, -5)\). (F)

8) Profit. The profit \( P \) (in dollars) for WidgetCo is given by:
   \[ P \text{ or } P(x) = -50x^2 + 700x - 2000, \]
   where \( x \) is the number of widgets produced and sold. Assume that the domain of \( P \) is \([0, \infty)\), and assume that every widget produced is sold. (A, B)
   a) What is the profit if no widgets are produced and sold?
      Hint: The company loses money then.
b) Use a formula to find the number of widgets (produced and sold) for which profit is maximized.

c) What is the corresponding maximum profit? (Calculator)

d) What are the breakeven production levels for the company? That is, how many widgets are to be produced and sold if the company’s profit is to be $0? There are two answers; give both.

9) **Projectile.** A projectile is fired over a flat desert. The height of the projectile is given by: \( h(t) = -16t^2 + 80t + 384 \), where \( t \) is time measured in seconds since the moment the projectile is fired. (The height formula is relevant up until the moment the projectile hits the ground.) Height \( h \) is measured in feet. (A, B)

a) What is the height of the projectile at the moment that it is fired?
b) Use a formula to find the length of time it takes (since it was fired) for the projectile to reach its maximum height.
c) What is the corresponding maximum height? (Calculator)
d) How long does it take for the projectile to hit the ground (from the moment the projectile was fired)?

**SECTION 2.2: POLYNOMIAL FUNCTIONS OF HIGHER DEGREE**

1) For each function \( f \) in a)-d) below, find \( \lim_{x \to \infty} f(x) \) and \( \lim_{x \to -\infty} f(x) \). (A-D)

a) \( f \), where \( f(x) = 5x^3 - 4x^2 + 9 \)
b) \( f \), where \( f(x) = 3x^4 + x^3 - \frac{1}{2}x^2 - 7x \)
c) \( f \), where \( f(x) = -x^6 + 15x^5 \)
d) \( f \), where \( f(x) = 14x^2 - 2x^7 \)

2) How many turning points (TPs) can the graph of \( y = f(x) \) have, if \( f \) is a 4\(^{th}\)-degree polynomial function? (E)

3) How many turning points (TPs) can the graph of \( y = f(x) \) have, if \( f \) is a 7\(^{th}\)-degree polynomial function? (E)

4) The graph of \( y = f(x) \), where \( f \) is a polynomial function, is below. The graph extends beyond the figure as expected. What do we know about \( f \)? (A-E)
5) How many distinct (i.e., different) real zeros can a 4th-degree polynomial have? (See if you can sketch graphs for the different cases.) (F)
6) Write a 4th-degree polynomial in $x$ in factored form that only has $-3, 0,$ and $5$ as its zeros. (F)
7) Write a polynomial in $x$ in factored form such that its only zeros are $-2$ (with multiplicity 2) and $4$ (with multiplicity 3).
8) Use the Intermediate Value Theorem to show that, if $f(x) = x^3 - 5x + 3$, then $f$ has a zero between 1 and 2. (G)
9) Let $f(x) = \frac{1}{30} (x + 3)^2 (x - 2)(x - 5)$. (H)
   a) Use the ideas of this section to graph $f$. You will not be able to locate some of the turning points exactly.
   b) Find the signs of $f(-4), f(0), f(3),$ and $f(6)$ using the given rule. Check to see that these results are consistent with your graph in a).

**SECTION 2.3: LONG AND SYNTHETIC POLYNOMIAL DIVISION**

1) Use Long Division to divide: $\frac{6x^3 + 2x^2 - 7x - 16}{2x^2 + 4x + 3}$. (A)
2) Use Long Division to divide: $\frac{12x^3 + 21x^2 - 17x - 16}{3x^2 - 2}$. (A)
3) Use Long Division to divide: $\frac{2 + 34x + 3x^2 - 12x^3 + x^5}{7x - x^3}$. (A)
4) Use Long Division to divide: $\frac{x^6 - x^3 + x^2 - x}{x^3 - 1}$. (A)
5) Let $f(x) = 3x^3 - 14x^2 + 16x - 21$ and $d(x) = x - 4$. (B, C)
   a) Use Synthetic Division to divide: $\frac{f(x)}{d(x)}$
   b) **Division algorithm.** Using your result from a), express $f(x)$ in the form $f(x) = d(x) \cdot q(x) + r$, where $q(x)$ is a polynomial, and $r$ is a real number. In the form, write out what $d(x), q(x),$ and $r$ are.
   c) Use the Remainder Theorem to evaluate $f(4)$. We will check this in d) & e).
   d) Use your form from b) to evaluate $f(4)$.
   e) Evaluate $f(4)$ using direct substitution into $f(x)$ (as usual).
6) Use Synthetic Division to divide: \( \frac{5x^5 + 10x^4 - 4x^2 - 5x - 1}{x + 2} \). (B)

7) Use Synthetic Division to prove the factoring formula for \( x^3 + 1 \). (B)

8) Use Synthetic Division to divide: \( \frac{x^4 - 1}{x - 1} \). (B)

9) Based on the pattern you observed in the previous Exercise, simplify \( \frac{x^n - 1}{x - 1} \), where \( n \) is a positive integer. (Your guess is a “conjecture.”) (B)

10) Let \( f(x) = 4 - x + 5x^2 + 6x^3 \) and \( d(x) = 2x + 1 \). We will divide \( f(x) \) by \( d(x) \) in two different ways. (A-C)
   a) Use Long Division.
   b) Use Synthetic Division, and compare your answer with the one from a).
   Hint: Factor the leading coefficient out of \( d(x) \) first.

11) **Zeros, Factoring, and Division.** Let \( f(x) = 15x^3 - 52x^2 + 19x + 6 \) and \( d(x) = x - 3 \). We will divide \( f(x) \) by \( d(x) \) in two different ways. (A, B, D)
   a) Use Long Division.
   b) Use Synthetic Division, and compare your answer with the one from a).
   c) Use the Remainder Theorem to evaluate \( f(3) \).
   d) Check your answer to c) by evaluating \( f(3) \) using direct substitution into \( f(x) \) (as usual).
   e) Factor \( f(x) \) completely over the integers, \( \mathbb{Z} \).
   f) Find all the real zeros of \( f \).

**SECTION 2.4: COMPLEX NUMBERS**

1) Simplify the following: a) \( \sqrt{-7} \); b) \( \sqrt{-9} \); c) \( \sqrt{-48} \). (A)

2) Plot the following complex numbers in the complex plane:
   a) 2; b) \( 4i \); c) \( -4i \); d) \( -3 + 5i \); e) \( -3 - 5i \). (B)

3) Evaluate \( i^0 + i^1 + i^2 + i^3 \). (C)

4) Evaluate the following powers of \( i \): a) \( i^{404} \); b) \( i^{405} \); c) \( i^{99} \); d) \( i^{42} \); e) \( i^{1000} \). (C)

5) Simplify the following. (A, C, D)
   a) \( \sqrt{-8} + \sqrt{-32} \)
   b) \( \sqrt{-16} \sqrt{-25} \) (Also, Yes or No: Is this equivalent to \( \sqrt{(-16)(-25)} \)?)
   c) \( (4 - 5i)^2 \)
6) Find the complex conjugates of the following:
   a) $6 + 5i$;  b) $2 - i\sqrt{7}$;  c) $-7$;  d) $-\pi i$. (E)

7) In Exercise 2, 2 is its own complex conjugate, $4i$ and $-4i$ are a pair of complex conjugates, and $-3 + 5i$ and $-3 - 5i$ are another pair. What is true about points representing a pair of complex conjugates in the complex plane? (E)

8) Simplify the following:  a) $\frac{2 + 3i}{5i}$;  b) $\frac{7 - 2i}{3 + 4i}$;  c) $\frac{3 + \sqrt{-20}}{2 - \sqrt{-5}}$. (A-F)

9) Find the complex zeros of $f$, where $f(x) = x^2 + 32$. (A, G)

10) Find the complex zeros of $g$, where $g(t) = 3t^2 - 4t + 5$. (A, G)

**SECTION 2.5: FINDING ZEROS OF POLYNOMIAL FUNCTIONS**

1) Let $f(x) = 3x^3 - 4x^2 - 5x + 2$. (B)
   a) Write the list of the possible rational zeros of $f$, based on the Rational Roots Theorem (or Rational Zero Test). Later, we will determine which of these candidates are, in fact, zeros.
   b) Use Synthetic Division to show that $-2$ is not a zero of $f$.
   c) Use Synthetic Division to show that $-1$ is a zero of $f$.
   d) Factor $f(x)$ completely over the integers, $\mathbb{Z}$.
   e) What are the three real zeros of $f$?
   f) Use the ideas of Section 2.2 to graph $f$. You do not have to locate the turning points exactly; you will learn how to find them in calculus.

2) Let $g(t) = 2t^4 - 3t^3 - 17t^2 + 12t + 36$. (B)
   a) Write the list of the possible rational zeros of $g$, based on the Rational Roots Theorem (or Rational Zero Test). Later, we will determine which of these candidates are, in fact, zeros.
   b) Use Synthetic Division to evaluate $g(4)$. Is 4 a zero of $g$?
   c) Use Synthetic Division to evaluate $g(3)$. Is 3 a zero of $g$?
   d) Use c) and then Factoring by Grouping to factor $g(t)$ completely over the integers, $\mathbb{Z}$.
   e) What are the four real zeros of $g$?
   f) Use the ideas of Section 2.2 to graph $s = g(t)$ in the $ts$-plane. You do not have to locate the turning points exactly; you will learn how to find them in calculus.
g) From task c), we know that \( g(t) \) can be partially factored as \( (t - 3)c(t) \), where \( c(t) \) is a cubic polynomial in \( t \). Write the list of the possible rational zeros of \( c \), based on the Rational Roots Theorem (or Rational Zero Test). Which possibilities from task a) are now eliminated?

h) Use Synthetic Division to show that \( -\frac{3}{2} \) is a zero of \( c \) (and thus a zero of \( g \)), and use this work to factor \( g(t) \) completely over the integers, \( \mathbb{Z} \). Compare your answer with the one from d). Hint: You will need to multiply factors at the end to accomplish this.

3) Factor \( x^4 - \pi^2 \) over \( \mathbb{R} \). (C)

4) Factor \( x^3 + 5 \) over \( \mathbb{R} \). (C)

5) Factor \( x^2 + 7 \) over \( \mathbb{C} \). (C)

6) Let \( f(x) = 4x^6 + 4x^4 - 48x^2 \). (C)
   a) Factor \( f(x) \) over \( \mathbb{Q} \) (or \( \mathbb{Z} \)), and find the rational zeros of \( f \).
   b) Factor \( f(x) \) over \( \mathbb{R} \), and find the real zeros of \( f \).
   c) Factor \( f(x) \) over \( \mathbb{C} \), and find the complex zeros of \( f \).

7) \( f(x) \) is a nonzero polynomial with (only) real coefficients, and \( 7i \) is a zero of \( f \). What other complex number must also be a zero of \( f \)? The factorization of \( f(x) \) over \( \mathbb{R} \) must contain what factor? (D)

8) \( f(x) \) is a nonzero polynomial with (only) real coefficients, and \( 4 - 5i \) is a zero of \( f \). What other complex number must also be a zero of \( f \)? The factorization of \( f(x) \) over \( \mathbb{R} \) must contain what factor? (D)

9) Let \( f(x) = x^5 - 4x^4 + 4x^3 \). Write all complex zeros of \( f \) and their multiplicities. (C, E)

10) Let \( f(x) = x^4 + 18x^2 + 81 \). Write all complex zeros of \( f \) and their multiplicities. (C, E)

11) How many real zeros can a 6th-degree polynomial with (only) real coefficients have? (A zero of multiplicity \( k \) counts \( k \) times.) Also, how many distinct real zeros could it have? (D, E)

12) How many real zeros can a 9th-degree polynomial with (only) real coefficients have? (A zero of multiplicity \( k \) counts \( k \) times.) Also, how many distinct real zeros could it have? (D, E)
13) Let \( f(x) = x^3 - x^2 + x - 21 \). (B, C, F)
   a) Write the list of the possible rational zeros of \( f \), based on the Rational Roots Theorem (or Rational Zero Test). Later, we will determine which of these candidates are, in fact, zeros.
   b) Factor \( f(x) \) over \( \mathbb{R} \).
   c) Find the complex zeros of \( f \).
   d) Factor \( f(x) \) over \( \mathbb{C} \). Use Linear Factorization Theorem (LFT) Form.

14) Let \( h(r) = 4r^4 + 13r^3 + 6r^2 - 4r + 8 \). (B, C, F)
   a) Write the list of the possible rational zeros of \( h \), based on the Rational Roots Theorem (or Rational Zero Test). Later, we will determine which of these candidates are, in fact, zeros.
   b) Use Synthetic Division to factor \( h(r) \) over \( \mathbb{R} \). Hint: \(-2\) is a zero of multiplicity 2.
   c) Find the complex zeros of \( h \).
   d) Factor \( h(r) \) over \( \mathbb{C} \). Use Linear Factorization Theorem (LFT) Form.

15) Let \( f(x) = 3x^3 - 4x^2 - 5x + 2 \), as we did in Exercise 1. Use only Descartes’s Rule of Signs for tasks a) and c). (G)
   a) List the possible numbers of \textbf{positive} real zeros of \( f \). (A zero of multiplicity \( k \) counts \( k \) times.)
   b) Review Exercise 1e. How many positive real zeros does \( f \) really have?
   c) List the possible numbers of \textbf{negative} real zeros of \( f \). (A zero of multiplicity \( k \) counts \( k \) times.)
   d) Review Exercise 1e. How many negative real zeros does \( f \) really have?

16) Let \( g(t) = 2t^9 - t^7 + \pi t^6 + \sqrt{3}t^5 - t^4 \). Use only Descartes’s Rule of Signs for tasks b) and c). (G)
   a) Before using Descartes’s Rule of Signs, we need to factor out the GCF. What is the multiplicity of 0 as a zero of \( g \)?
   b) List the possible numbers of \textbf{positive} real zeros of \( g \). (A zero of multiplicity \( k \) counts \( k \) times.)
   c) List the possible numbers of \textbf{negative} real zeros of \( g \). (A zero of multiplicity \( k \) counts \( k \) times.)
SECTION 2.6: RATIONAL FUNCTIONS

1) Consider the graph of \( y = f(x) \) in the usual \( xy \)-plane, where \( f(x) = \frac{5x - 1}{2x^2 + x - 3} \).

If an answer to a task below is none, write “NONE.” (A-E)

a) Find the hole(s) on the graph of \( f \), if any. (Holes correspond to “removable discontinuities.”)

b) Find the equation(s) of the vertical asymptote(s) (VAs) of the graph, if any.

c) Find the equation of the horizontal asymptote (HA) of the graph, if any.

d) Find the \( x \)-intercept(s) of the graph, if any.

e) Find the \( y \)-intercept of the graph, if any.

2) Consider the graph of \( y = f(x) \) in the usual \( xy \)-plane, where
\[
f(x) = \frac{6x^4 - 24x^3 + 24x^2}{3x^4 + 3x^3 - 18x^2}.
\]
If an answer is none, write “NONE.” (A-E)

a) Simplify \( f(x) \).

b) Find the hole(s) on the graph of \( f \), if any. (Holes correspond to “removable discontinuities.”)

(c) Find the equation(s) of the vertical asymptote(s) (VAs) of the graph, if any.

d) Find the equation of the horizontal asymptote (HA) of the graph, if any.

e) Find the \( x \)-intercept(s) of the graph, if any.

f) Find the \( y \)-intercept of the graph, if any.

3) Let \( f(x) = \frac{6x^3 + 2x^2 - 7x - 16}{2x^3 + 4x + 3} \). In Section 2.3, Exercise 1, we performed the division and obtained \( 3x - 5 + \frac{4x - 1}{2x^2 + 4x + 3} \). Consider the graph of \( y = f(x) \) in the usual \( xy \)-plane. Give an equation for the slant asymptote (SA) for the graph. (D)

4) Let \( f(x) = \frac{x^8 - 7x^5}{x^2 + 1} \). In the “long run” (i.e., as \( x \to \infty \) and \( x \to -\infty \)), the graph of \( y = f(x) \) resembles the graph of a polynomial function of what degree? (If we were to perform Long Division here, we can find an equation for a “nonlinear asymptote” for the graph.) (D)

5) Graph \( y = \frac{x^2 - 25}{x - 5} \). (E)

6) Graph \( y = \frac{x - 5}{x^2 - 25} \). (E)

7) Graph \( y = f(x) \), where the function \( f \) is described as in Exercise 1. (F)

8) Graph \( y = f(x) \), where the function \( f \) is described as in Exercise 2. (F)
SECTION 2.7: NONLINEAR INEQUALITIES

Write the solution sets and domains for 1)-5) below in interval form.

1) Solve the inequality $x^2 + 2x > 3$.
2) Let $f(x) = \sqrt{16 - x^2}$. Find $\text{Dom}(f)$.
3) Let $g(t) = \frac{1}{\sqrt{t^2 - 25}}$. Find $\text{Dom}(g)$.
4) Let $h(r) = \sqrt[3]{r^4 + r^3 - 1}$. Find $\text{Dom}(h)$.
5) Let $f(x) = \sqrt[4]{2 + 5x - 3x^2}$. Find $\text{Dom}(f)$.
6) Let $f(x) = \sqrt{x^3 - x^2}$. Write $\text{Dom}(f)$ in set-builder form.
CHAPTER 3: Exponential and Logarithmic Functions

(A) means “refer to Part A,” (B) means “refer to Part B,” etc.
(Calculator) means “use a calculator.” Otherwise, do not use a calculator.

SECTION 3.1: EXPONENTIAL FUNCTIONS AND THEIR GRAPHS

1) Sketch the graphs of $y = 3^x$ and $y = \left(\frac{1}{3}\right)^x$ in the same coordinate plane. (B)

2) Let $f(x) = 3^x$. Find $\text{Dom}(f)$ and $\text{Range}(f)$. Write these sets in interval form. (B)

3) Use your calculator to round off $e$ to seven significant digits. (Calculator) (C)

4) Interest. On the day of a child’s birth, a deposit of $1700 is made in a trust fund that pays 4.2% annual interest compounded annually. Assuming there are no further deposits or withdrawals, how much money will there be in the account after eight years? Round off to the nearest cent. (Calculator) (D, E)

5) Interest. Repeat Exercise 4, except use:
   a) monthly compounding
   b) continuous compounding

SECTION 3.2: LOGARITHMIC FUNCTIONS AND THEIR GRAPHS

1) Evaluate the following. (A-D)
   a) $\log_4 256$
   b) $\log_8 2$
   c) $\log_7 \left(\frac{1}{49}\right)$
   d) $\log_{25} \left(\frac{1}{5}\right)$
   e) $\log 1000$
   f) $\ln \left(e^9\right)$
   g) $\log_8 1$
   h) $\log_7 7$
   i) $\log_3 \left(3^{12}\right)$
   j) $2^{\log_8 p}$ (if $p > 0$)
2) Let \( f(x) = 6^x \). What is \( f^{-1}(x) \)? Graph \( f \) and \( f^{-1} \) in the same coordinate plane.

In Exercises 3-5, write the indicated sets in interval form.

3) Let \( g(x) = \log x \). Find \( \text{Dom}(g) \) and \( \text{Range}(g) \). (E)

4) Let \( h(t) = \log_4 (t + 5) \). Find \( \text{Dom}(h) \) and \( \text{Range}(h) \). (F)

5) Let \( f(x) = \ln(x^2 - 64) \). Find \( \text{Dom}(f) \). (F)

**SECTION 3.3: MORE PROPERTIES OF LOGARITHMS**

1) Evaluate \( \log_8 16 + \log_8 4 \). (A-E)

2) Expand the following, and evaluate where appropriate. Assume that all variables only take on positive values. (A-E)

   a) \( \ln(x^4 y^3) \); b) \( \log_2 \left[ \frac{(p + 2)^3}{32} \right] \); c) \( \ln \left( \frac{e^6 \sqrt[3]{x}}{y^7} \right) \); d) \( \log \left[ \frac{10,000 a^5}{b^3 c^4} \right] \);

   e) \( \log_7 (x^3) + \log_7 (x) + \log_7 [(xy)^7] + \log_7 (xy^5) \)

3) Condense the following. Assume that variables only take on positive values. (A-F)

   a) \( 2 \log_3 x + 4 \log_3 y \)

   b) \( 3 \log a - 4 \log (b - c) \)

   c) \( 3 \ln x + 4 \ln y - \frac{3}{4} \ln z - 5 \ln w \)

4) Without using a calculator, find the two consecutive integers that \( \log_3 200 \) must lie between.

5) Use a formula to approximate \( \log_3 200 \) to four decimal places. (Calculator) (G)

**SECTIONS 3.4 AND 3.5:**

**EXPONENTIAL AND LOGARITHMIC EQUATIONS AND MODELS**

1) Find all real solutions of the following exponential equations. Give exact solutions; if a solution is irrational, then also approximate it to five significant digits. (Calculator) (A-C)

   a) \( 5 \left( 3^x \right) - 15 = 45 \)

   b) \( 3^{x+1} = 81 \)

   c) \( 4^{3p-2} = 16^{5p} \)

   d) \( e^{2x} - 4e^x = 0 \). Hint: Factor.

   e) \( 2e^{2x} - 13e^x + 15 = 0 \). Hint: Factor.
2) **Interest.** (Revisiting Section 3.1, Exercises 4 and 5.) On the day of a child’s birth, a deposit of $1700 is made in a trust fund that pays 4.2% annual interest compounded continuously. Assuming there are no further deposits or withdrawals, how old will the child be when there is $3000 in the account? Give both an exact answer (which may look ugly) and an approximate answer rounded off to the nearest tenth of a year. (Calculator) (A-C)

3) **Interest.** Repeat Exercise 2, except find how old the child will be when there is $3400 in the account. Hint: Use the Doubling Time Formula discussed in this section. Compare your answer here to your answer in Exercise 2. (Calculator) (A-C)

4) **Interest.** Repeat Exercise 2, except find how old the child will be when there is $5100 in the account. Hint: Use a modification of the Doubling Time Formula. (Calculator) (A-C)

5) **Population decay.** At noon, a toxin is added to a Petri dish full of bacteria. An exponential decay model for the number of bacteria remaining in the Petri dish is given by: \( P(t) = P_0 e^{-0.472t} \), where \( P(t) \) is the number of bacteria in the Petri dish \( t \) hours after noon. It was estimated that there were 3200 bacteria in the Petri dish at noon. (Calculator) (A-C)
   a) In how many hours after noon will there be only 100 bacteria remaining in the Petri dish? Give both an exact answer (which may look ugly) and an approximate answer rounded off to four significant digits.
   b) What time does that correspond to, to the nearest minute?

6) Find all real solutions of the following logarithmic equations. Give exact solutions; if a solution is irrational, then also approximate it to five significant digits. (Calculator) (A, D)
   a) \( \log_5 x - 5 = -2 \)
   b) \( 2 \ln(x + 2) = 14 \)
   c) \( \log_3 \left[ (4x - 1)^4 \right] = 12 \). Assume \( x > 1/4 \).

   **ADDITIONAL PROBLEM:** What are the solutions if we relax (remove) the assumption?
   d) \( \log(9x) - 2 \log(x + 2) = 0 \)
   e) \( \log_4 (x + 2) + \log_4 (x - 4) = 2 \)
   f) \( \log_2 (10x + 2) - \log_2 (7x - 5) = 1 \)
   g) \( \log_5 x - \log_5 (x + 1) = 4 \)
   h) \( \ln(x + 1) + \ln x = 1 \)