To the Student:

After your registration is complete and your proctor has been approved, you may take the Credit by Examination for Algebra 2B.

WHAT TO BRING

- several sharpened No. 2 pencils
- graphing calculator

ABOUT THE EXAM

The exam will consist of 40 questions, most of which require you to show your work. The exam is based on the Texas Essential Knowledge and Skills (TEKS) for this subject. The full list of TEKS is included in this document (it is also available online at the Texas Education Agency website, http://www.tea.state.tx.us/). The TEKS outline specific topics covered in the exam, as well as more general areas of knowledge and levels of critical thinking. Use the TEKS to focus your study in preparation for the exam.

The examination will take place under supervision, and the recommended time limit is three hours. You may not use any notes or books. A percentage score from the examination will be reported to the official at your school.

In preparation for the examination, review the TEKS for this subject. All TEKS are assessed. It is important to prepare adequately. Since questions are not taken from any one course, you can prepare by reviewing any of the state-adopted textbooks that are used at your school. The textbook used with our ALG 2B course is Algebra II, 2008 Texas edition, by Prentice Hall, Inc.

We have included a sample examination with this letter. The sample exam will give you a model of the types of questions that will be asked on your examination. It is not a duplicate of the actual examination. It is provided to illustrate the format of the exam, not to serve as a complete review sheet.

Good luck on your examination!
Preparing for the CBE

For successful completion of the CBE, you should be able to do the following:

- solve quadratic equations by graphing;
- solve quadratic equations by factoring;
- solve quadratic equations by completing the square;
- solve quadratic equations by using the quadratic formula;
- find quadratic equations that fit given conditions;
- name the vertex, axis of symmetry, and direction of opening for the graph of a quadratic in the form \( y = a(x - h)^2 + k \);
- find the distance between two points in the coordinate plane;
- find the midpoint of a line segment in the coordinate plane;
- graph parabolas given certain properties;
- graph circles given certain properties;
- graph ellipses given certain properties;
- graph hyperbolas given certain properties;
- identify conic sections from their equations;
- evaluate polynomial functions;
- solve nonquadratic equations using quadratic techniques;
- find the inverse of a function or relation;
- solve problems involving direct, inverse, and joint variation;
- simplify rational expressions;
- simplify complex fractions;
- add and subtract rational expressions;
- solve rational equations;
• solve equations involving real exponents;
• write exponential equations in logarithmic form and vice versa;
• evaluate logarithmic expressions;
• solve equations involving logarithmic functions;
• evaluate expressions involving logarithms with different bases.

You should review these subjects to prepare yourself for the exam.
Sample CBE Questions

Answer the following questions on your own paper.

1. Solve by graphing: $x^2 + 6x - 40 = 0$
2. Solve by factoring: $x^2 + 9x + 20 = 0$
3. Solve by completing the square: $x^2 + 10x - 39 = 0$
4. Solve by using the quadratic formula: $x^2 - 5x - 66 = 0$
5. Write a quadratic equation that has roots $-\frac{5}{2}$ and 3.
6. Name the vertex, axis of symmetry, and direction for $f(x) = 3x^2 + 42x + 142$.
7. Find the distance between the points (6, –4) and (–3, 8).
8. Find the midpoint of the segment whose endpoints are at (–5, 9) and (11, –1).
9. Graph $(x - 1)^2 = 12(y - 1)$.
10. Graph $x^2 + y^2 + 8x - 24y + 16 = 0$.
11. Graph $49x^2 + 16y^2 = 784$.
12. Graph $9y^2 - 4x^2 = 36$.
13. State whether the graph of $7x^2 + 9y^2 = 63$ is a parabola, a circle, an ellipse, or a hyperbola.
14. Find $p(a + 1)$ if $p(x) = 5x - x^2 + 3x^3$.
15. Solve $y - 4\sqrt{y} - 45 = 0$
16. Find the inverse of $f(x) = -3x + 1$.
17. If $y$ varies inversely as $x$ and $x = 14$ when $y = -6$, find $x$ when $y = -11$.
18. Simplify: $\frac{(x^2 - 4) \cdot (x - 3)}{(x^2 - 9) \cdot (x + 2)}$
19. Simplify: $\frac{\frac{1}{x}}{\frac{2x}{17}}$
20. Simplify: \( \frac{(14)}{(x + y)} - \frac{(9x)}{(x^2 - y^2)} \)

21. Solve: \( \frac{3}{y} + \frac{7}{y} = 9 \)

22. Solve: \( 2^{(6x)} = 4^{(5x+2)} \)

23. Write \( 3^3 = 27 \) in logarithmic form.

24. Evaluate \( \log_3 3^5 \).

25. Solve for \( b \): \( \log_b 16 = 4 \)

26. Approximate the value of \( \log_8 72 \) to three decimal places.
Sample CBE Answers

1. \(-10, 4\)
2. \(-4, -5\)
3. \(-13, 3\)
4. \(11, -6\)
5. \(2x^2 - x - 15 = 0\)
6. Vertex is \((-7, -5)\); axis of symmetry is \(x = -7\); opens upward.
7. Distance is 15.
8. \((3, 4)\)
9. Vertex is \((1,1)\); focus is \((1, 4)\); axis of symmetry is \(x = 1\); directrix is \(y = -2\); opens upward; length of latus rectum is 12 units.
10. Center \((-4, 12)\); radius is 12 units
11. Center is \((0, 0)\); x-axis intercept is \(\pm 4\), y-axis intercept is \(\pm 7\)
12. Center is \((0, 0)\); vertices are \((0, 2)\) and \((0, -2)\); foci is \((0, \sqrt{13})\) and \((0, -\sqrt{13})\); asymptote slope is \(\pm \frac{2}{3}\).
13. Ellipse
14. \(3a^3 + 8a^2 + 12a + 7\)
15. \(y = 81\)
16. \(\frac{(-x+1)}{3}\)
17. \(y = \frac{84}{11}\)
18. \(\frac{x-2}{x+3}\)
19. \(\frac{17}{2x^2}\)
20. \[ \frac{(5x - 14y)}{(x + y)(x - y)} \]

21. \[ y = \frac{10}{9} \]

22. \[ x = -1 \]

23. \[ 3 = \log_3 27 \]

24. \[ x = 5 \]

25. \[ b = 2 \]

26. approximately 2.057
**General Formulas**

**Slope of a Line:** \( m = \frac{y_2 - y_1}{x_2 - x_1} \)

**Quadratic formula:** \( x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \)

**Value of a second order determinant:** \( \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc \)

**Cramer’s rule:** The solution to the system \( \begin{cases} ax + by = e \\ cx + dy = f \end{cases} \) is \((x, y)\), where

\[
x = \frac{eb - af}{ad - bc}, \quad y = \frac{fa - be}{ad - bc}, \quad \text{and} \quad \begin{vmatrix} a & b \\ c & d \end{vmatrix} \neq 0
\]

**Scalar multiplication of a matrix:**

\[ k \begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix} = \begin{bmatrix} ka & kb & kc \\ kd & ke & kf \end{bmatrix} \]

**Expansion of a third-order determinant:**

\[
\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a \begin{vmatrix} e & f \\ h & i \end{vmatrix} - b \begin{vmatrix} d & f \\ g & i \end{vmatrix} + c \begin{vmatrix} d & e \\ g & h \end{vmatrix}
\]

**Area of triangles:** The area of a triangle having vertices at \((a, b)\), \((c, d)\), and \((e, f)\) is

\[
|A|, \text{ where } A = \frac{1}{2} \begin{vmatrix} a & b & 1 \\ c & d & 1 \\ e & f & 1 \end{vmatrix}
\]

*continued →*
Negative exponents: For any real number \( a \), and any integer \( n \), where \( a \neq 0 \),

\[
a^{-n} = \frac{1}{a^n} \text{ and } \frac{1}{a^{-n}} = a^n
\]

Degree of a constant: The degree of a constant is always zero

Properties of powers

Suppose \( m \) and \( n \) are integers and \( a \) and \( b \) are real numbers. Then the following properties hold.

Power of a product: \((ab)^n = a^m b^n\)

Power of a quotient: \(\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \), \( b \neq 0 \) and

\[
\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n \text{ or } \frac{b^n}{a^n} \), \( a \neq 0 \), \( b \neq 0 \)

Multiplying Powers: For any real number \( a \) and integers \( m \) and \( n \), \( a^m \times a^n = a^{m+n} \)

Dividing Powers: For any real number \( a \), except \( a = 0 \), and integers \( m \) and \( n \), \( \frac{a^m}{a^n} = a^{m-n} \)

Factoring

Any number of terms:

Greatest Common Factor (GCF): \( a^3b^2 + 2a^2b - 4ab^2 = ab(a^2b + 2a - 4b) \)

Two terms:

Difference of Two Squares \( a^2 - b^2 = (a + b)(a - b) \)

Sum of Two Cubes \( a^3 + b^3 = (a + b)(a^2 - ab + b^2) \)

Difference of Two Cubes \( a^3 - b^3 = (a - b)(a^2 + ab + b^2) \)

continued →
Three terms:
Perfect Square Trinomials
\[ a^2 + 2ab + b^2 = (a + b)^2 \]
\[ a^2 - 2ab + b^2 = (a - b)^2 \]
General Trinomials
\[ acx^2 + (ad + bc)x + bd = (ax + b)(cx + d) \]

Four or more terms:
Grouping
\[ ra + rb + sa + sb = r(a + b) + s(a + b) = (r + s)(a + b) \]

Logarithms

Product: \( \log_b (xy) = \log_b x + \log_b y \)

Quotient: \( \log_b \left( \frac{x}{y} \right) = \log_b x - \log_b y \)

Power: \( \log_b (x^r) = r \log_b x \)

Absolute Value Functions

Vertical translation
Parent function: \( y = |x| \) \( y = f(x) \)
Translation up \( k \) units, \( k > 0 \): \( y = |x| + k \) \( y = f(x) + k \)
Translation down \( k \) units, \( k > 0 \): \( y = |x| - k \) \( y = f(x) - k \)

Horizontal translation
Parent function: \( y = |x| \) \( y = f(x) \)
Translation right \( k \) units, \( k > 0 \): \( y = |x - h| \) \( y = f(x - h) \)
Translation left \( k \) units, \( k > 0 \): \( y = |x + h| \) \( y = f(x + h) \)

Combined translation
Translation right \( h \) units, up \( k \) units: \( y = |x - h| + k \) \( y = f(x - h) + k \)

continued →
Graph of a quadratic function in standard form

The graph of \( f(x) = ax^2 + bx + c \) is a parabola when \( a \neq 0 \).

- When \( a > 0 \), the parabola opens up. When \( a < 0 \), the parabola opens down.

- The axis of symmetry is the line \( x = -\frac{b}{2a} \).

- The \( x \)-coordinate of the vertex is \( -\frac{b}{2a} \). The \( y \)-coordinate of the vertex is the \( y \) value of the function when \( x = -\frac{b}{2a} \), or \( y = f\left(-\frac{b}{2a}\right) \).

- The \( y \)-intercept is \((0, c)\).

Discriminant of a matrix

<table>
<thead>
<tr>
<th>Value of the discriminant</th>
<th>Type and number of solutions for ( ax^2 + bx + c = 0 )</th>
<th>Examples of graphs of related functions ( y = ax^2 + bx + c )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( b^2 - 4ac &gt; 0 )</td>
<td>two real solutions</td>
<td>two ( x )-intercepts</td>
</tr>
<tr>
<td>( b^2 - 4ac = 0 )</td>
<td>one real solution</td>
<td>one ( x )-intercept</td>
</tr>
<tr>
<td>( b^2 - 4ac &lt; 0 )</td>
<td>no real solutions, two imaginary solutions</td>
<td>no ( x )-intercept</td>
</tr>
</tbody>
</table>
### Families of conic sections

<table>
<thead>
<tr>
<th>Conic Section</th>
<th>Standard Form of Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parabola</strong></td>
<td>Vertex (0,0)</td>
</tr>
<tr>
<td></td>
<td>( y = ax^2 )</td>
</tr>
<tr>
<td></td>
<td>( x = ay^2 )</td>
</tr>
<tr>
<td><strong>Circle</strong></td>
<td>Center (0,0)</td>
</tr>
<tr>
<td></td>
<td>( x^2 + y^2 = r^2 )</td>
</tr>
<tr>
<td><strong>Ellipse</strong></td>
<td>Center (0,0)</td>
</tr>
<tr>
<td></td>
<td>( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 )</td>
</tr>
<tr>
<td></td>
<td>( \frac{x^2}{b^2} + \frac{y^2}{a^2} = 1 )</td>
</tr>
<tr>
<td><strong>Hyperbola</strong></td>
<td>Center (0,0)</td>
</tr>
<tr>
<td></td>
<td>( \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 )</td>
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<td></td>
<td>( \frac{y^2}{a^2} - \frac{x^2}{b^2} = 1 )</td>
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