TI-Nspire CX II CAS Reference & Study Guide

Comprehensive Synthesis of Core Calculator Workflows for VCE Mathematical Methods

Second Edition (v2) — Updated with Bidirectional Transformations, Point Mapping & Exam Exemplars

Abstract

This publication-ready reference guide integrates the core pedagogical and computational workflows developed for the **TI-Nspire CX II CAS** handheld across VCE Mathematical Methods Units 1–4. Covering algebraic constraints, simultaneous equation engines, calculus quadrature, continuous probability density verification, discrete inverse binomial distributions, composite function domain theory, and complete bidirectional graphical transformations with point mapping, each section pairs exact calculator syntax with rigorous mathematical explanations and authentic examination strategies.

1. Domain Restrictions, Constraints & Piecewise Functions

1.1 Handheld Access & Keypress Sequence

On the physical TI-Nspire CX II CAS keyboard:

- Press `[ctrl]` + `[=]` to open the relation/inequality palette, then select the vertical bar `|` (the "given/with" constraint operator).
- In the **Graphs Application**: Press `[ctrl]` + `[I]` → `Add Graphs`, type the expression, append `|`, enter the domain inequality, and press `[Enter]`.

Domain Graphing Syntax Examples

- **Cubic Polynomial:** $f1(x) = x^3 + 2x^2 - 7x - 11 \mid -4 \leq x \leq \frac{10}{3}$
- **Rational Function:** $f1(x) = \frac{-2}{x-3} + 2 \mid -5 < x < 4$
- **Radical Curve:** $k(x) = 3\sqrt{4x-7} + 2 \mid x > 4$
- **Exact Compound Domain:** $f1(x) = \sqrt{x+2} \mid x \geq -2$ and $x \leq 3 \implies$ Domain: $[-2, 3]$, Range: $[0, \sqrt{5}]$

1.2 Restricting by Range using the `when()` Command

While the `|` operator restricts the independent variable (x-domain), filtering or bounding a function by its **dependent variable** (y-range) requires the `when()` piecewise selector:

Syntax: **when**(**condition**, **true_expr**[, **false_expr**])

$$f(x) = \text{when}(-7 \leq 3x + 11 \leq 5,\ 3x + 11)$$

This restricts the outputs of $3x + 11$ strictly between -7 and 5, returning `undef` outside this range.

1.3 Instant Substitution and Parameter Isolations

The constraint operator `|` enables immediate local evaluation without altering stored variables:

- **Derivative at a point:** $\frac{d}{dx}(x^3 - 3x)\Big|_{x=2} = \mathbf{9}$.
- **Restricting Equation Solving Intervals:** $\text{solve}(\sin(2x) = 0, x) \mid 0 \leq x \leq 2\pi \implies x \in \left\{0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi\right\}$.
- **Newton's Method Single-Step Step:** $x_1 = 4 - \frac{f(4)-1/5}{f'(4)}\Big|_{x=4}$ via `| x=4`.

2. Solving Simultaneous Systems of Equations

The TI-Nspire CX II CAS provides two robust avenues for solving simultaneous systems: the linear template wizard (`linSolve`) and the general symbolic equation solver (`solve`).

2.1 Method 1: Linear Systems via `linSolve`

1. Press `menu` → **3: Algebra** (or **6: Calculation** → **3: Algebra** in Notes) → **7: Solve System of Equations** → **2: Solve System of Linear Equations**.
2. Specify the number of equations and comma-separated variable list (e.g., a, b, c).

`linSolve` Syntax & Output Format

$$\text{linSolve}\left(\begin{cases} 7a + 2b + c = 7 \\ 4a - 5b - 2c = 3 \\ -2a + 11b = 4 \end{cases}, \{a, b, c\}\right) \implies \left\{\frac{191}{196}, \frac{53}{98}, -\frac{177}{196}\right\}$$

The CAS outputs an ordered list matching the variable arguments directly.

2.2 Method 2: General Systems via `solve()`

For non-linear systems (e.g., conic intersections, line-parabola systems) or parametrised lines, enter equations linked with the `and` operator:

- **Linear System:** $\text{solve}(3x + 2y = 7 \text{ and } -4x + 11y = 2,\ \{x, y\}) \implies x = \frac{73}{41} \text{ and } y = \frac{34}{41}$.
- **Non-Linear Intersection:** $\text{solve}(\{y = x^2,\ y = 2x + 3\},\ \{x, y\}) \implies (x = -1, y = 1) \text{ or } (x = 3, y = 9)$.

2.3 Interpreting Parameter Cases in Exam Questions

When solving linear equations with an unknown parameter k (e.g. VCAA 2026 Examination 2 Section A Question 2):

- **Inconsistent System (No Solution / Parallel Lines):** When two lines have identical gradients but different intercepts:

$$\text{solve}(\{2x - y = -30,\ 2x - y = -12\},\ \{x, y\}) \implies \textbf{false} \text{ (or } \textit{no solution})$$

- **Dependent System (Infinitely Many Solutions / Collinear Lines):** If equations are scalar multiples of each other, the CAS returns an equation expressed with an arbitrary parameter (e.g., c_1).

3. Calculus & Definite Integration Workflows

3.1 Fast Templates & Command Syntax

- **Keyboard Shortcut:** Press `[Shift]` + `[+]` to immediately place the 4-field definite integral template $\int_{\square}^{\square} \square \, d\square$.
- **Menu Navigation:** `menu` → **4: Calculus** → **3: Integral**.
- **Typed Equivalent:** `integral(expr, x, lower, upper)`.

Calculus Evaluation Examples

$$\int_0^3 x^2\,dx = 9, \qquad \int_0^2 x^2\,dx = \frac{8}{3}$$
$$\int_0^1 (x^3 - 3x)\,dx = -\frac{5}{4}, \qquad \int_0^6 xe^{-x/2}\,dx = 4 - 16e^{-3}$$

3.2 Signed Integral versus Total Geometric Area

A definite integral evaluates **net signed area**. Where a curve crosses the horizontal axis, regions below contribute negatively:

- For $f(x) = x^3 - 3x$ on $[0, 2]$, the net integral is $\int_0^2 (x^3 - 3x)\,dx = -2$.
- To obtain the **total geometric area**, determine the roots ($\text{solve}(f(x) = 0, x) \implies x = \sqrt{3}$) and split the interval, or use the absolute value template:

$$\text{Area} = \int_0^2 |x^3 - 3x|\,dx = \left|\int_0^{\sqrt{3}} (x^3 - 3x)\,dx\right| + \int_{\sqrt{3}}^2 (x^3 - 3x)\,dx = \mathbf{\frac{5}{2}}$$

- **Area Enclosed Between Two Curves:** For $y = 2x$ and $y = x^2$ on $[0, 2]$:

$$\int_0^2 (2x - x^2)\,dx = \mathbf{\frac{4}{3}}$$

3.3 Numerical Approximations (`nInt`)

When expressions lack an analytical elementary antiderivative, use `nInt(expr, x, lower, upper)` or evaluate the exact integral with `[ctrl] + [Enter]`. In the Graphs Application, select `menu` → **6: Analyze Graph** → **7: Integral** to shade the region and display the signed area visually.

4. Continuous Probability Density Functions (PDFs)

To verify that a continuous function $f(x)$ constitutes a legitimate PDF, two fundamental mathematical axioms must be proven.

4.1 The Two Core PDF Criteria

1. **Total Probability Law:** The total integral over the distribution support must equal 1:

$$\int_{-\infty}^{\infty} f(x)\,dx = 1$$

2. **Non-Negativity Condition:** The probability density cannot be negative at any point:

$$f(x) \geq 0 \quad \text{for all } x \in \text{dom}(f)$$

Piecewise & Interval PDF Verification

- **Single Interval:** For $h(x) = \frac{3}{4} - \frac{3}{4}(10 - x)^2$ on $[9, 11]$:

$$\int_9^{11} h(x)\,dx = 1 \qquad \text{and} \qquad \text{solve}(h(x) < 0, x) \mid 9 \leq x \leq 11 \implies \textbf{false}$$

- **Piecewise Multi-branch Function:** Using the piecewise template:

$$f1(x) = \begin{cases} \frac{x}{250}, & 5 \le x \le 15 \\ \frac{(x-45)^2}{15000}, & 15 < x \le 45 \end{cases} \implies \int_5^{15} \frac{x}{250}\,dx + \int_{15}^{45} \frac{(x-45)^2}{15000}\,dx = \frac{2}{5} + \frac{3}{5} = \mathbf{1}$$

4.2 Solving for Unknown Normalising Constants

When an unknown parameter scales the density (e.g. VCAA 2026 Examination 2 Section A Question 17):

Normalising Constant Exemplar

Given $g(x) = q\left(\sin(x) - \frac{1}{2}\right)$ on $\left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$, solve for q:

$$\text{solve}\left(q\int_{\pi/6}^{5\pi/6}\left(\sin(x) - \frac{1}{2}\right)dx = 1,\ q\right) \implies \mathbf{q} = \frac{-\mathbf{3}}{\pi - \mathbf{3}\sqrt{\mathbf{3}}} = \frac{\mathbf{3}}{\mathbf{3}\sqrt{\mathbf{3}} - \pi}$$

4.3 Expected Value, Variance & Conditional Probability

Once validated, compute distribution metrics symbolically:

$$E(X) = \int_a^b x \cdot f(x)\,dx, \qquad E(X^2) = \int_a^b x^2 \cdot f(x)\,dx, \qquad \text{Var}(X) = E(X^2) - [E(X)]^2$$

$$\Pr(H > 9.25 \mid H < 9.5) = \frac{\int_{9.25}^{9.5} h(x)\,dx}{\int_{9}^{9.5} h(x)\,dx}$$

5. Inverse Binomial: Success Cutoffs (`invBinom`)

5.1 Purpose & Syntax

The `invBinom` command determines the **smallest integer number of successes (k)** such that the lower-tail cumulative probability $\Pr(X \le k)$ reaches or exceeds a target probability:

Syntax: **invBinom(CumProb, n, p[, 0 | 1])**

- `0` **(default):** Returns the scalar integer threshold k.
- `1`**:** Returns a 2×2 validation matrix displaying $k-1$ and k with their exact cumulative probabilities.

Worked Exam Example: Direct Cutoff

A test has $n = 12$ multiple choice questions with $p = 0.4$. Find the least k such that $\Pr(X \le k) \ge 0.90$.

`invBinom(0.90, 12, 0.4)` $\implies \mathbf{k = 7}$

Verification via `binomCdf`:

$$\begin{aligned} \text{For } k = 6: &\quad \Pr(X \le 6) = \text{binomCdf}(12, 0.4, 0, 6) \approx 0.8418 < 0.90 \\ \text{For } k = 7: &\quad \Pr(X \le 7) = \text{binomCdf}(12, 0.4, 0, 7) \approx 0.9427 \ge 0.90 \end{aligned}$$

The Crucial Upper-Tail Exam Trap

Examiners frequently ask for *"at least k successes with probability at least α"* ($\Pr(X \ge k) \ge \alpha$). Because the CAS operates strictly from the lower tail, you must transform the condition before entering it:

$$\Pr(X \ge k) \ge \alpha \iff 1 - \Pr(X \le k-1) \ge \alpha \iff \Pr(\mathbf{X \le k - 1}) \le \mathbf{1} - \alpha$$

6. Inverse Binomial: Minimum Trials (`invBinomN`)

6.1 Purpose & Syntax

The `invBinomN` command determines the **minimum number of trials** (n) required to achieve a cumulative probability target for a fixed cutoff of successes (k):

Syntax: **invBinomN(CumProb, p, k[, 0 | 1])**

Worked Exam Example 1: Multiple Successes

Let $X \sim \text{Bin}(n, 0.4)$. Find the smallest sample size n such that $\Pr(X \geq 5) \geq 0.95$.

1. **Convert Upper Tail:** $\Pr(X \geq 5) \geq 0.95 \iff \Pr(X \leq 4) \leq 0.05$.
2. **CAS Parameters:** `CumProb` $= 0.05$, $p = 0.4$, $k = 4$.
3. **CAS Execution:** `invBinomN(0.05, 0.4, 4, 0)` $\implies$ **21**.
4. **Matrix Validation (argument `1`):**

$$\texttt{invBinomN(0.05, 0.4, 4, 1)} \implies \begin{bmatrix} 20 & 0.05095 \\ 21 & 0.03696 \end{bmatrix}$$

At $n = 20$, $\Pr(X \leq 4) \approx 0.0510 > 0.05$. At $n = 21$, $\Pr(X \leq 4) \approx 0.0370 \leq 0.05$. Thus, $\mathbf{n = 21}$.

Worked Exam Example 2: At Least One Success

For a manufacturing line with failure rate $p = 0.3$, how many items n must be sampled such that $\Pr(X \geq 1) \geq 0.95$?

$$\Pr(X \geq 1) \geq 0.95 \iff \Pr(X = 0) \leq 0.05$$

$$\texttt{invBinomN(0.05, 0.3, 0)} \implies \mathbf{n = 9}$$

7. Composite Function Domains: The Overlap Fallacy

7.1 Pointwise Operations vs. Composition

A common misconception in Mathematical Methods is assuming that $\text{dom}(f)$ and $\text{dom}(g)$ must overlap for a composite function $(f \circ g)(x) = f(g(x))$ to exist.

- **Pointwise Operations ($f \pm g$, $f \cdot g$):** Both functions evaluate the *identical input* x simultaneously, requiring $\text{dom}(f) \cap \text{dom}(g) \neq \emptyset$.
- **Function Composition ($f \circ g$):** The outer function f never evaluates x; it only receives $g(x)$. Hence, **$\text{dom}(f)$ and $\text{dom}(g)$ can be completely disjoint**.
- **Composite Existence Condition:** $(f \circ g)(x)$ exists if and only if:

$$\text{ran}(\mathbf{g}) \cap \text{dom}(\mathbf{f}) \neq \emptyset \qquad (\text{or } \text{ran}(g) \subseteq \text{dom}(f) \text{ for the full natural domain})$$

7.2 Three In-Depth Domain Determinations

7.2.1 Example 1: Disjoint Domains with a Valid Composite

Let $g(x) = 3x - 12$ for $x \geq 0 \implies \text{dom}(g) = [0, \infty)$, $\text{ran}(g) = [-12, \infty)$.
Let $f(u) = \ln(-u) \implies \text{dom}(f) = (-\infty, 0)$.

1. Check overlap: $\text{dom}(g) \cap \text{dom}(f) = [0, \infty) \cap (-\infty, 0) = \emptyset$ (CAS confirms `false`).
2. Match inner range to outer domain: $\text{ran}(g) \cap \text{dom}(f) = [-12, \infty) \cap (-\infty, 0) = [-12, 0)$.
3. Solve for x: $-12 \leq 3x - 12 < 0 \implies 0 \leq 3x < 12 \implies \mathbf{0 \leq x < 4}$.
4. Result: $(f \circ g)(x) = \ln(12 - 3x)$ with $\text{dom}(f \circ g) = [0, 4)$ and $\text{ran}(f \circ g) = (-\infty, \ln(12)]$.

7.2.2 Example 2: Reversing the Composition Order

Using the same base rules for $(g \circ f)(x) = g(f(x))$:

$$f(x) = \ln(-x),\ \text{dom}(f) = (-\infty, 0) \qquad g(u) = 3u - 12,\ \text{dom}(g) = [0, \infty)$$

Require $f(x) \in \text{dom}(g) \iff \ln(-x) \geq 0 \implies -x \geq e^0 = 1 \implies \mathbf{x \leq -1}$.
Thus, $\text{dom}(g \circ f) = (-\infty, -1]$ with mapped range $\text{ran}(g \circ f) = [-12, \infty)$.

7.2.3 Example 3: Radical and Logarithmic Interplay

Let $f(x) = \sqrt{x-1}$ ($\text{dom} = [1, \infty)$) and $g(x) = \ln(5 - x)$ ($\text{dom} = (-\infty, 5)$).

- For $(f \circ g)(x) = \sqrt{\ln(5-x) - 1}$: Require $\ln(5 - x) \geq 1 \implies 5 - x \geq e \implies \mathbf{x \leq 5 - e}$.
  Domain: $(-\infty, 5 - e]$.
- For $(g \circ f)(x) = \ln(5 - \sqrt{x-1})$: Require $x \geq 1$ and $\sqrt{x-1} < 5 \implies 0 \leq x - 1 < 25 \implies \mathbf{1 \leq x < 26}$.
  Domain: $[1, 26)$.

7.3 CAS Graphing Techniques for Composites

- In the Graphs Application, enter $f1(x) = g(x)$ and $f2(x) = f(x)$.
- Enter $f3(x) = \mathbf{f2(f1(x))}$. The CAS graphing engine automatically computes and graphs strictly across the restricted composite domain.
- Use `domain(f2(f1(x)), x)` on a Calculator page to analytically verify boundaries.

8. Graphical Transformations & Bidirectional Mapping

Transformations are tested extensively in VCE Mathematical Methods, requiring students to fluently map individual coordinates, derive transformed functions, backtrack from transformed curves to the base relation, and equate structural arguments between two defined equations.

8.1 Point Mapping: Coordinates to Their Image

Under a sequence of dilations, reflections, and translations, every original coordinate point (x, y) on $y = f(x)$ maps to an image point (x', y') on $y = g(x)$.

8.1.1 General Mapping Formula

For any transformed function represented in the standard form:

$$g(x) = A \cdot f(Bx + C) + D \qquad (A \neq 0,\ B \neq 0)$$

Any original coordinate point (u, v) maps to its image point according to:

$$(\mathbf{u}, \mathbf{v}) \longmapsto \left(\frac{\mathbf{u - C}}{\mathbf{B}},\ \mathbf{A \cdot v + D} \right)$$

- **Horizontal Component:** If $x_{\text{new}} = Bx + C$, solving for the original x gives $x = \frac{x_{\text{new}} - C}{B}$. Thus, the input to f transforms as $u \mapsto \frac{u-C}{B}$.
- **Vertical Component:** The output of the function is scaled by A and translated by D: $v \mapsto Av + D$.

VCAA Exam 2 Exemplar: Multi-Step Point Transformation

Question (VCAA 2026 Exam 2 Section A Q1): The point $(2, -5)$ undergoes a translation of 4 units in the negative direction of the y-axis, followed by a reflection in the x-axis. Find the coordinates of the image point.

1. **Original point:** $(2, -5)$.

2. **Translation 4 units down (negative y-direction):**

$$(2, -5) \longmapsto (2, -5 - 4) = (2, -9)$$

3. **Reflection in the x-axis (negate the y-coordinate):**

$$(2, -9) \longmapsto (2, -(-9)) = (\mathbf{2}, \mathbf{9})$$

CAS List Keystroke Verification:
On a Calculator page, assign the coordinate pair to list variable `p`:

```
{2, -5} -> p          ⟹ {2, −5}
{p[1], (p[2] - 4) * (-1)} ⟹ {2, 9}
```

8.1.2 Inverse Point Mapping: Reversing to Original Coordinates

To find the original point (u, v) given an image point (u', v'):

$$(\mathbf{u}', \mathbf{v}') \longmapsto \left(\mathbf{B}\mathbf{u}' + \mathbf{C},\ \frac{\mathbf{v}' - \mathbf{D}}{\mathbf{A}}\right)$$

For example, under $g(x) = -2f(-3x + 1) + 5$, an image point $\left(-\frac{2}{3}, 5 - 2\sqrt{7}\right)$ backtracks to:

$$u = -3\left(-\frac{2}{3}\right) + 1 = 3, \qquad v = \frac{(5 - 2\sqrt{7}) - 5}{-2} = \sqrt{7} \implies (\mathbf{3}, \sqrt{\mathbf{7}})$$

8.2 Forward Function Transformations: Primed Coordinate Method

To find the equation of a curve resulting from multiple successive transformations, employ the **method of primed coordinates**:

1. **Define Image Variables:** Express x' and y' in terms of the original coordinates x and y.
2. **Invert for Original Variables:** Make the original variables x and y the subjects of the equations.
3. **Substitute into Base Function:** Replace x and y in $y = f(x)$ with their expressions in terms of x' and y'.
4. **Isolate Image Rule:** Rearrange for y' and remove prime marks.

Worked Forward Transformation Problem

Problem: Let $f(x) = \sqrt{9 - x^2}$. Find the rule of $g(x)$ after applying:

1. Dilation by factor 2 from the y-axis (parallel to x-axis).
2. Translation of 3 units in the positive x-direction.
3. Dilation by factor 2 from the x-axis and reflection in the x-axis.
4. Translation of 1 unit in the positive y-direction.

Mathematical Working:

1. Setting up primed coordinates:

$$x' = 2x + 3 \qquad \text{and} \qquad y' = -2y + 1$$

2. Inverting for x and y:

$$x = \frac{x' - 3}{2} \qquad \text{and} \qquad y = \frac{1 - y'}{2}$$

3. Substituting into $y = \sqrt{9 - x^2}$:

$$\frac{1 - y'}{2} = \sqrt{9 - \left(\frac{x' - 3}{2}\right)^2} \implies 1 - y' = 2\sqrt{9 - \left(\frac{x' - 3}{2}\right)^2}$$

4. Final rule:

$$\mathbf{g(x) = -2\sqrt{9 - \left(\frac{x - 3}{2}\right)^2} + 1}$$

Domain & Range Mapping on CAS:
Original: $\text{dom}(f) = [-3, 3]$ and $\text{ran}(f) = [0, 3]$.
Transformed domain: $-3 \leq \frac{x-3}{2} \leq 3 \implies -6 \leq x - 3 \leq 6 \implies [\mathbf{-3, 9}]$.
Transformed range: $y \in [-2(3) + 1, -2(0) + 1] = [\mathbf{-5, 1}]$. Verified via `domain(g(x), x)`.

8.3 Backwards Transformations: Backtracking to the Original Curve

In complex examination problems, students are given the transformed curve $y = g(x)$ and the sequence of forward transformations, and must deduce the original base function $y = f(x)$.

The Backtracking Principle

If the forward transformations map original coordinates (x, y) to image coordinates (x', y') via:

$$x' = T_x(x) \qquad \text{and} \qquad y' = T_y(y)$$

The transformed curve in primed coordinates is $y' = g(x')$. Substituting the forward expressions $x' = T_x(x)$ and $y' = T_y(y)$ **directly** into $y' = g(x')$ immediately yields the original equation in terms of x and y.

Worked Backtracking Example

Question: A curve $y = f(x)$ undergoes the following sequence of transformations:

- Horizontal dilation by factor $\frac{1}{3}$ from the y-axis,
- Reflection in the y-axis,
- Translation of $\frac{1}{3}$ units in the positive x-direction,
- Vertical reflection in the x-axis, vertical dilation by factor 2, and translation 5 units up,

resulting in the curve $g(x) = -2\sqrt{-3x + 5} + 5$. Find the rule of the original function $f(x)$.
Solution:

1. **Forward mapping expressions:**

$$x' = -\frac{1}{3}x + \frac{1}{3} = \frac{1 - x}{3} \implies 3x' = 1 - x \implies -3x' = x - 1$$

$$y' = -2y + 5$$

2. **Substitute into $y' = g(x')$:**

$$-2y + 5 = -2\sqrt{-3x' + 5} + 5$$

Substitute $-3x' = x - 1$:

$$-2y + 5 = -2\sqrt{(x - 1) + 5} + 5 \implies -2y + 5 = -2\sqrt{x + 4} + 5$$

3. **Isolate y:** Subtract 5 and divide by -2:

$$y = \sqrt{x + 4} \implies \mathbf{f(x) = \sqrt{x + 4}}$$

8.4 Transformation Sequences Between Two Defined Rules (Exam Strategy)

When an exam problem asks for the sequence of transformations mapping one explicit function $g(x)$ onto another $w(x)$, equate their structural core components:

VCAA Exam 2 Section B Exemplar: Two-Curve Mapping

VCAA 2026 Examination 2 Section B Question 5(g):
The sequence of two transformations maps $g(x) = \frac{1}{\sqrt{1-x}} + 1 - k$ to $w(x) = \frac{1}{\sqrt{2-2x}} + k$ on $(-\infty, 1)$. Find the two transformations in terms of k.
Working via Structural Equivalence:

1. Write image relation: $y' = w(x') = \frac{1}{\sqrt{2(1-x')}} + k$.
2. Set the argument of the square root equal to the core of $g(x)$:
$$1 - x' = 1 - x \implies x' = x \quad \text{(No horizontal transformation)}$$
3. Relate the function values:
$$y' - k = \frac{1}{\sqrt{2}\sqrt{1-x}} = \frac{1}{\sqrt{2}}(y - (1-k))$$
4. Expand and rearrange for y':
$$y' = \frac{1}{\sqrt{2}}y - \frac{1-k}{\sqrt{2}} + k = \frac{\sqrt{2}}{2}y + k + \frac{\sqrt{2}(k-1)}{2}$$
5. Form $y' = ay + h$:
$$\mathbf{a = \frac{\sqrt{2}}{2}}, \qquad \mathbf{h = k + \frac{\sqrt{2}(k-1)}{2}}$$

Conclusion:
1. A dilation by a factor of $\frac{\sqrt{2}}{2}$ from the x-axis (parallel to the y-axis).
2. A translation of $k + \frac{\sqrt{2}(k-1)}{2}$ units in the positive direction of the y-axis.

8.5 Further VCAA Examination Transformation Insights

- **Trigonometric Derivative Mapping (VCAA 2026 Exam 2 Section A Q10):**
Mapping $f'(x) = -\pi \sin(\pi x + 3)$ onto $f(x) = \cos(\pi x + 3)$.
Using the identity $-\sin\left(\pi\left(x - \frac{1}{2}\right) + 3\right) = \cos(\pi x + 3)$, this requires a translation of $\frac{1}{2}$ units right (positive x-direction) and a vertical dilation by factor $\frac{1}{\pi}$ from the x-axis.
- **Parallel Line Separation (VCAA 2026 Exam 2 Section A Q19):**
For $f(x) = \frac{4}{3}x - 7$, a translation by (h, v) produces perpendicular separation $d = \frac{|3v-4h|}{5}$. For $d = 5$, $|3v - 4h| = 25$, satisfied by translation vector $(h, v) = (4, -3)$ (Option B).

End of TI-Nspire CX II CAS Comprehensive Study & Reference Document (Edition 2.0)