# 

**Unit**

**4**

**EQUATIONS AND INEQUALITIES**

# KEY CONCEPTS

**TEACHER’S GUIDE**

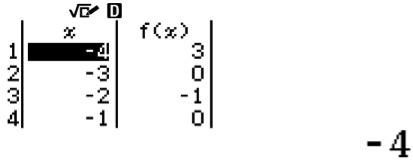
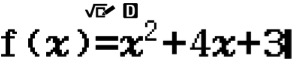
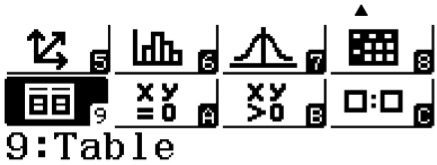
**Methods to solve a quadratic equation**

## Factorisation

This method only works for roots that are usually simple fractions or integers.

Example *x*2 + 4*x* + 3 = 0 (*x* + 3)(*x* + 1) = 0

*x* = –3 or –1



Press = to see the table of values.

As you can see, when f(*x*) = 0, *x* = –3 or –1.

Hence the solutions to the equation *x*2 + 4*x* + 3 = 0 are *x* = –3 or –1.

Note: Teacher needs to cleverly select the values so that the solutions/roots will

be within the range that you set. For this

question, it is set from –4 to 0 because the roots are –3 and –1.

Press z4=0= to select a start of –4 and end at 0.

Press == to skip g(*x*). You should see this:

Press Q)d+4[+3

Select 9 for Table functions. You should see this:

**ClassWiz steps**

Press w.

**Casio ClassWiz Mathematics Workbook**

## Completing the square

This method works for all equations as long as there are real roots.

E*x*ample 2 + 3*x* + 1 = 0

2 + 3*x* + – + 1 = 0

– + 1 = 0

=

+ = ±

= – or – –

= or

## Quadratic Formula

*x* =

This method works for all equations as long as there are real roots.

This is formula is derived from the Completing the Square method.

Example 3*x*2 – 7*x* + 1 = 0

*x* == or

**TEACHER’S GUIDE**

## Graphical Method

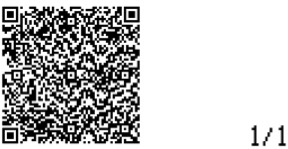
This method works for all equations as long as there are real roots.

If the graph is drawn by hand, there may be inaccuracies as human error cannot be avoided. You will get a more accurate answer if you use a graphing software.

The ClassWiz calculator has a QR code function where it allows users to scan the QR code generated on the calculator using the Casio EDU+ application on your mobile device.

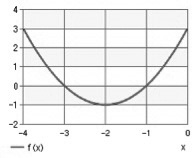
Using the example of *x*2 + 4*x* + 3 = 0 as covered under factorisation earlier, we simply continue on to press

qT to obtain the QR code.



Next, we scan the QR code using the Casio EDU+ application on your mobile device.

Select the option of ‘Open in Browser’ and you will see the following graph:



Unit 4 **Equations and Inequalities**

# Inequalities

**TEACHER’S GUIDE**

1. Addition: If *a* < *b*, then *a* + *c* < *b* + *c*.
2. Subtraction: If *a* < *b*, then *a* – *c* < *b – c*
3. Multiplication by a positive number: If *a* < *b*, then *ac* < *bc*.
4. Division by a positive number: if *a* < *b*, then <

1. Multiplication by a negative number: If *a* < *b* and *c* < 0, then *ac* > *bc*.
2. Division by a negative number: If *a* < *b* and *c* < 0, then >
3. Note that the sign changes for 5 and 6.

This also applies to all other inequalities such as < , ≤ and ≥ .

# Quadratic Inequalities

For a quadratic expression that can be factorised or expressed as (*x – a*)(*x – b*) where *a* < *b*

## Case 1

For (*x – a*)(*x – b*) > 0, the roots are *a* and *b*.

*a*

*b*

This portion is above the *x*-axis, and is > 0.

*x*

Since the portion we want is **above** the *x*-axis, the parts of the curve (represented by the curves in bold) that lies in this portion above the *x*-axis is what we want. To represent the curves in bold algebraically, we write it as *x* < *a* or *x* > *b*.

## Case 2



For (*x – a*)(*x – b*) < 0, the roots are *a* and *b*.

*x*

This portion is below the *x*-axis, and is < 0.

Since the portion we want is **below** the *x*-axis, the parts of the curve (represented by the part of the curve in bold) that lie in this portion below the *x*-axis is what we want. To represent the bold part of the curve algebraically, we write it as *a* < *x* < *b*, as it is a continuous region of values.

# Sum and Product of Roots

For a quadratic equation *ax*2 + *bx* + *c* = 0, let the roots of the equation be given as *a* and 𝛽.

Take note of the negative sign that needs to be applied only for sum of roots.

Sum of roots, *a* + 𝛽= – .

Product of roots, *a*𝛽

= .

Sum and differences of cubes = (*a* ± 𝛽)(*a*2 ± *a*𝛽+ 𝛽 2)

**Casio ClassWiz Mathematics Workbook**

**TEACHER’S GUIDE**

## Useful formulas to memorise for easy substitution of sum of roots and product of roots

1. *a*2 + 𝛽 2 = (*a* + 𝛽)2 – 2*a*𝛽

2. *a*3 + 𝛽 3 = (*a* + 𝛽)(*a*2 – *a*𝛽+ 𝛽2)

= (*a* + 𝛽)(*a*2 + 𝛽2 – *a*𝛽)

= (*a* + 𝛽)[(*a* + 𝛽)2 – 3*a*𝛽]

## Nature of roots

The value of the discriminant, *b*2 – 4*ac*, describes the nature of the roots of the quadratic equation.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Discriminant** | **Nature of roots** | **Characteristics** | **Diagram** | | | | | |
| *b*2 – 4*ac* > 0 | 2 real and distinct roots | The quadratic curve cuts the  *x*-axis at 2 different points. |  | *a* | *y* | *b* |  | *x* |
| *b*2 – 4*ac* = 0 | 2 real and equal roots | The quadratic curve cuts the  *x*-axis at only 1 point.  The *x*-axis is the tangent to the curve. |  |  | *y*  *a* |  |  | *x* |
| *b*2 – 4*ac* < 0 | No real roots | The curve does not touch the  *x*-axis at all. | Case 1:  Case 2: |  | *y*  *y* |  |  | *x*  *x* |
|  |  | Case 1: The curve opens upward and is completely above the *x*-axis. |
|  |  | Case 2: The curve opens downwards and is completely below the *x*-axis. |

Unit 4 **Equations and Inequalities**

*y*

*y =* 8*x2 –* 20*x +* 8

*y =* 6*x –* 7

0.75

2.5

# WORKED EXAMPLES

**TEACHER’S GUIDE**

## Worked Example 1

Solve *x*2 + 5*x* + 3 = 0 by

It is very important to note here that we can use the ClassWiz calculator’s function to double check if our answer is correct.

1. completing the square.
2. quadratic formula.

This is a very useful function that you can use throughout the whole book. It is covered in Unit 3.

and *x*2 =.

*x*1 =

**ClassWiz steps**

Press wQz2 and 2 again to select a degree of 2 to get a quadratic

equation. Press 1 for the coefficient of *x*2, 5 for coefficient of *x*, and 3 as the constant term. Press = and you will be able to see

the answer displayed as

Solution

1. *x*2 + 5*x* + -=0

=

+ = ±

= or

(b) *x*2 + 5*x* + 3 = 0

=

= or

## Worked Example 2

In the following quadratic graph, state the range of values of *x* for 8*x*2 – 20*x* + 8 > 6*x* – 7.

*x*

For 8*x*2 – 20*x* + 8 > 6*x* – 7,

it means that we want the portion where the graph is ‘higher’ than the line,

measured by the value of *y*.

Solution

The solution from the graph is *x* < 0.75 or *x* > 2.5

## Worked Example 3

Solve the simultaneous inequalities: 3*x* + 5 > –2*x* – 10

13 – 7*x* ≥ 5*x* + 9

Note that the overlapping region is –3 < *x* ≤ .This means that this range of values of *x* satisfies **both**

inequalities (1) and (2).

Solution

3*x* + 5 > –2*x* – 10 …(1)

13 – 7*x* ≥ 5*x* + 9 …(2)

From (1), 5*x* > –15

*x* > –3 …(3)

From (2), 4 ≥ 12*x*

*x* ≤　…(4)

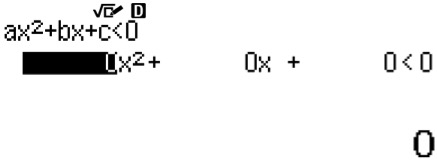
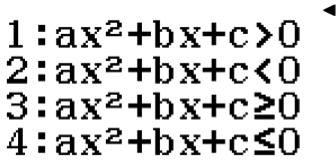
*x*

–3 1

3

The solution is –3 < *x* ≤ .

**Casio ClassWiz Mathematics Workbook**



**TEACHER’S GUIDE**

## Worked Example 4

Solve the quadratic inequality (*x* + 5)(2*x* – 7) < 0. Solution

–5

7

2

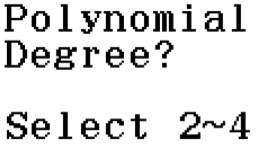
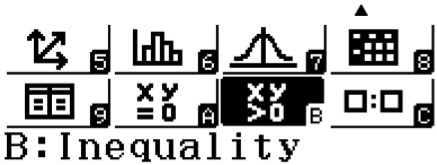
*x*

By drawing the quadratic function and observing the inequality as shown in the diagram, we can see

that the roots are given as *x* = –5 and *x* = . Also, the inequality‘< 0’ shows that we are interested in the

shaded portion below the *x*-a*x*is, where y < 0. We need to represent algebraically the part of the curve that is in the shaded portion.

The solution is –5 < *x* < .



**ClassWiz steps**

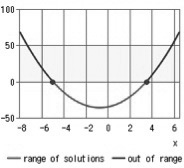
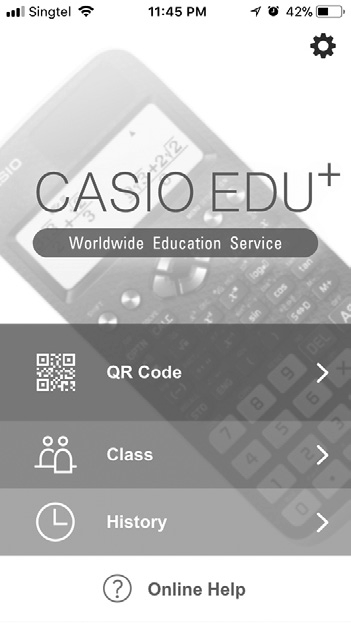
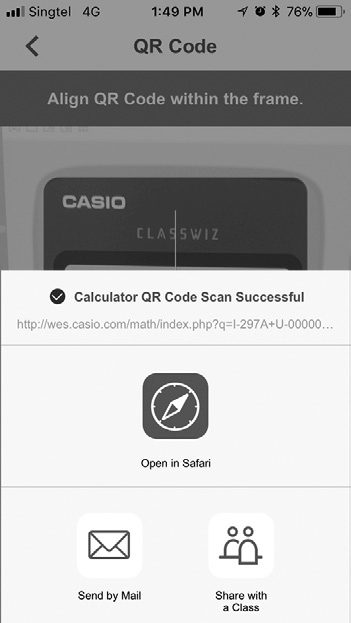
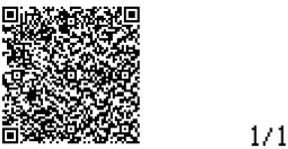
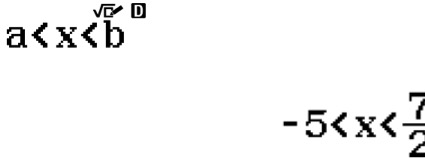
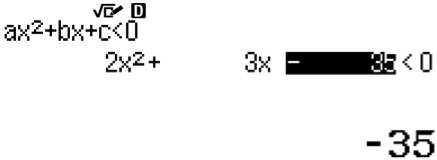
You can use the QR code function of ClassWiz to see shape of the inequality. Press w

Press Qx to select B for Inequality. You should see this:

Press 2 for a degree of 2.

Press 2 to select *ax*2 + *bx* + *c* < 0.

Unit 4 **Equations and Inequalities**



Press 2=3=z35= to key in the coefficients and constant term.

**TEACHER’S GUIDE**

Press = to get the result.

Press qT to obtain the QR code specially for ClassWiz calculators.

Scan this QR code with Casio EDU+ application on your mobile device.

Select the option of ‘Open in Browser’ and you will see the following graph:

As you can see from your mobile device, the coloured range of solutions is given by

–5 < *x* < 3.5.

**Casio ClassWiz Mathematics Workbook**

## Worked Example 5

Determine the set of values of *m* for which the equation 3m*x* + (*m* + 2)*x*2 + *m* = 0 has 2 distinct and real roots.

Solution Discriminant > 0

Observe that this is a quadratic inequality. Hence, apply steps needed to solve the quadratic inequality here.

(3*m*)2 – 4(*m* + 2)(*m*) > 0 9*m*2 – 4*m*2 – 8*m* > 0

5*m*2 – 8*m* > 0

*m*(5*m* – 8) > 0

*m*

0

8

5

*m* < 0 or *m* > .

## Worked Example 6

The roots of the quadratic equation 5*x*2 + 2*x* + 9 = 0 are 𝑎and 𝛽. Find a quadratic equation whose roots are 𝑎2 + 1 and 𝛽2 + 1.

Solution

The approach of this question is not to find 𝑎or 𝛽because they are non-real numbers. The approach is to use the value of sum of roots and product of roots to find what the question requires.

5*x*2 + 2*x* + 9 = 0

Sum of roots = –

𝑎+ 𝛽= – …(1)

Product of roots =

𝑎𝛽= …(2)

Note that for sum of roots, the formula

is – . Take note of the negative sign.

Sum of new roots = 𝑎2 + 1 + 𝛽2 + 1

= 𝑎2 + 𝛽2 + 2

Apply this formula so that it is easier to substitute in the value of sum of roots and product of roots.

= 𝑎𝛽+ 2

= – 2+ 2

=

Product of new roots = (𝑎2 + 1)(𝛽2 + 1)

= 𝑎2𝛽2 + 𝑎2 + 𝛽2 + 1

= (𝑎𝛽)2 + (𝑎+ 𝛽)2 – 2𝑎𝛽+ 1

=+–2+ 1

=

New equation: *x*2 + *x* +  = 0 or +36*x*+20 = 0

Note that the equation is formed

by taking *x*2 – (– )*x* + = 0.

**TEACHER’S GUIDE**

Unit 4 **Equations and Inequalities**

# CLASSWIZ WORKSHEETS

**CLASSWIZ WORKSHEETS**

**Level 1 **

1. Solve each of the following quadratic equations by factorisation.

|  |  |  |  |
| --- | --- | --- | --- |
| (a) | *x*2 – *x* – 6 = 0 | (b) | 3*x*2 – 5*x* – 2 = 0 |
| (c) | 2*x*2 + 5*x* + 3 = 0 | (d) | 2*x*2 + 5*x* – 3 = 0 |
| (e) | 2*x*2 – 5*x* + 3 = 0 | (f ) | – *x*2 – 6*x* – 5 = 0 |

Teachers may point out to students that with minor changes of the signs in the equation, it can give rise to entirely different factors.

1. Solve each of the following quadratic equations by completing the square.

|  |  |  |  |
| --- | --- | --- | --- |
| (a) | *x*2 – 5*x* – 8 = 0 | (b) | *x*2 + 3*x* – 1 = 0 |
| (c) | *x*2 – 2*x* – 4 = 0 | (d) | *x*2 + 4*x* – 6 = 0 |
| (e) | *x*2 + 11*x* – 9 = 0 | (f ) | *x*2 – 7*x* + 9 = 0 |

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. Solve each of the following quadratic equations by using quadratic formula.

|  |  |  |  |
| --- | --- | --- | --- |
| (a) 3*x*2 – 7*x* + 1 = 0 | | (b) | 2*x*2 + 9*x* – 3 = 0 |
| (c) 3*x*2 – 7*x* + 1 = 0 3*x*2 – 7*x* + 1 = 0 | *x*2+ 5*x* – 1 = 0 | (d) | 4*x*2 + 2*x* – 3 = 0 |
| (e) – *x*2 + 3*x* + 3 = 0 | | (f ) | – 5*x*2 – 2*x* + 1 = 0 |

1. Solve the following linear inequalities.

|  |  |  |
| --- | --- | --- |
| (a) *x* + 1 > 0 | (b) | 3*x* – 2 < 0 |
| (c) – 2*x* + 4 > 0 | (d) | 2*x* – 5 > 0 |
| (e)*x* + 3 < – 4 | (f ) – < 0 | |

Unit 4 **Equations and Inequalities**

1. In each of the following quadratic graphs, state the range of values of *x* for the given inequality.

**CLASSWIZ WORKSHEETS**

(b) (2*x* –5)( 2*x* + 1 )< 0

(a) (5*x* + 7)(*x* – 1) > 0

*y*

*y*

*y =* (*5x +* 7)(*x –* 1)

*y =*(2x – 5)(2x + 1)

*x*

*x*

-

-

1

(c) –3+ 14*x* + 5 > 0

*y*

*x*

-

-

(d) –6 –13 *x* – 5 < 0

*y = –*14*x–*5

*y*

**Casio ClassWiz Mathematics Workbook**

*y*

*y =* –2*x2* + 10*x –* 7

*y = x –* 3

1

2

*x*

4



*y*

*y =* (*x +* 5)(*x* + 1)

*y =* 5

*x*

–6

0

*x*

*x*

2

–3

(g) + 2*x* – 10 <7*x* – 8

(h) – 2*x* + 5 >–3*x*+ 11



*y*

*y = x2 –* 2*x* + 5

*y =* –3*x* + 11

*x*

*y =* 7*x –* 8

*-* 5

-

2

*y =* –3*x2* + 2*x –* 10

*y*

(e) (*x* + 5)(*x* + 1) > 5

(f) –2+ 10*x* – 7 > *x* –3

*y = –*13*x–*5

-

5

**CLASSWIZ WORKSHEETS**

1. In each of the following cubic graphs, state the range of values of *x* for the given inequality.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| (a) (*x* + 1)(*x* + 2)(*x* – 3) > 0  *y* | | | | | | (b) (2*x* + 3)(*x* + 1)(*x* – 1) < 0  *y* | | | | | | |
| *y =* (*x +* 1)(*x* + 2)(*x –* 3)  3  *x* | | | | | |  | | | | | | |
|  | | | | | |  | | | | | | |
|  | | | | | | *x*  *–* 1 | | | | | | |
| –2 –1 |  |  |  |  |  |  |  |  | 1 |  |  |  |
|  | | | | | |  | | | | | | |
|  | | | | | | -  *y =* (2*x +*3)(*x* + 1))(*x –* 1) | | | | | | |
|  | | | | | |  | | | | | | |
|  | | | | | |  | | | | | | |
|  | | | | | |  | | | | | | |
| (c) – 2*x*3 – *x*2 + 13*x* – 6 > 0  *y*  *x*    2    –3  *y =* –2*x3 – x2* + 13*x –* 6 |  |  |  |  |  | (d) – 3*x*3 – *x*2 – 8*x* + 4 < 0 | | | | | | |
| *y*    1  *y =* – 3 – – 8*x* + 4  *x* | | | | | | |
|  | | | | | | |
| –2 |  |  |  |  |  |  |
|  | | | | | | |
|  | | | | | | |
| (e) 3*x*3 + 7*x*2 – 10*x* – 21 > 4*x* + 3  *y*  -  2  *x*  *y =* 3*x3 +* 7*x2 –* 10*x –* 21  *y =* 4*x* + 3    –3 | | | | | | (f ) 4*x*3 – 12*x*2 – 16*x* + 8 < 3*x* – 4 | | | | | | |
| *x*  *y* | | | | | | |
| *y =* 3*x –* 4 | | | | | | |
| –1.5 |  | 0.5 |  |  |  |  |
|  | | | | | | |
| 4 | | | | | | |
|  | | | | | | |
| *y =* 4*x3 –* 12*x2 –* 16*x* + 8 | | | | | | |
| (g) 12*x*3 – 65*x*2 + 25*x* + 20 < 3*x* + 5 | | | | | | (h) – 12*x*3 + 28*x*2 + 54*x* – 28 < – 5*x* + 7 | | | | | | |
| *y*  -    *x* | | | | | | *y*      *x* | | | | | | |
|  | | | | | |  | | | | | | |
| *y =* 3*x* + 5 | | | | | | *y =* –12*x3* + 28*x2* + 54*x* – 28 | | | | | | |
|  | | | | | |  | | | | | | |
|  |  |  |  |  |  |  |  |  |  |  | 3.5 |  |
|  |  | 5 |  |  |  |
|  |  |  |  |  |  |
|  | | | | | |  | | | | | | |
| *y =* 12*x3 –* 65*x2* + 25*x* + 20 | | | | | | *y =* –5*x* + 7 | | | | | | |

Unit 4 **Equations and Inequalities**

1. Solve each of the following pairs of simultaneous inequalities.

**CLASSWIZ WORKSHEETS**

|  |  |
| --- | --- |
| (a) *x* + 5 > 3  2*x* – 7 < 5 | (b) 5*x* – 7 > 2*x* – 3 17*x* – 13 ≤ 5*x* + 11 |
| (c) 2*x* – 5 > 3*x* + 6  *x* – 9 ≤ 16 | (d) + 3 < 1 *x* – 7  2*x*2 – 5*x* + 3 < 3*x* + 2*x*2 – 4 |
| (e) ≥  > 3*x* + | |

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. Solve each of the following quadratic inequalities.

**ClassWiz set-up**

Press wQx to select B for Inequality.

Press 2. From there, you can select the fitting inequality to the questions.

|  |  |
| --- | --- |
| (a) (*x* – 2)(3*x* – 7) > 0 | (b) (2*x* – 5)(3*x* + 4) < 0 |
| (c) *x*2 – 5*x* + 6 > 0 | (d) 4*x*2 + 4*x* – 3 < 0 |
| (e) *x*2 – 4 < 0 | (f ) (*x* – 1)2 > 0 |
| (g) 4*x*2 – 6*x* + 5 < – 2*x* + 8 | (h) 2*x*2 + 15*x* + 15 > – *x*2 + 2*x* + 3 |
| (i) 2(*x*2 + 3*x* – 2) > *x* – 1 | (j) 2(2 + *x*)(3 – *x*) < 7*x* + 15 |

Unit 4 **Equations and Inequalities**

1. By evaluating the discriminant, determine the nature of each quadratic function.

**CLASSWIZ WORKSHEETS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (a) | 2*x*2 – 6*x* – 3 = 0 | (b) | 7*x*2 – *x* + 4 = 0 | (c) | 4*x*2 + 9 = 12*x* |
| (d) | 3*x*2 + 11 = 9*x* | (e) | – 3*x*2 + 7*x* = 4 | (f ) | *x* = 9 + 5*x*2 |
| (g) | 9*x*2 + 24*x* + 16 = 0 | (h) | 7*x*2 = 9*x* + 5 | (i) | 5*x*(5*x* – 2) = – 1 |

# Level 2

1. Solve the pair of simultaneous equations.

*y* = 3*x*2 – *x* + 2

*y* = 6 – 5*x*

1. Solve the pair of simultaneous equations. 2*y* + *x* = 1

*y* = *x*2 + 2*x* – 1

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. Solve the pair of simultaneous equations.

*y* = *x*2 + 2*x* – 4

– 5*x* + 6*y* = – 11

1. Solve the pair of simultaneous equations.

*y* = 2*x*(3*x* – 2) – (2*x* – 1)2

*y* + 7 = 7*x*

1. Solve the pair of simultaneous equations.

*y* = 4*x* – *x*2

*y* = – 2 +

1. Determine the set of value(s) of *m* for which the equation 7*x* + (3*m* + 1)*x*2 + 9 = 0 has equal and real roots.
2. Determine the set of values of *p* for which the equation (*p* + 3)*x*2 + 5*x –* 9 = 0 has real and distinct roots.

Unit 4 **Equations and Inequalities**

1. Determine the set of values of *k* for which the equation –*kx*2 + 3*x* + 2 = 0 has no real roots.

**CLASSWIZ WORKSHEETS**

1. Determine the set of value(s) of *m* for which the equation 3*x*2 – 4*x* + *m* = 3 has equal and real roots.
2. Determine the set of values of *k* for which the equation 2*x*2 + 5*x*– *kx*2 + 3 = 0 has real and distinct roots.
3. Determine the set of values of *k* for which the equation 5*x*2 – 3*x* + *k* = 2 has no real roots.
4. Determine the set of value(s) of *p* for which the equation (2*p* – 1)*x*2 – *x* + 3 = 0 has equal and real roots.
5. Determine the set of values of *m* for which the equation (1 – 3*m*) + *x*2 = 2*x* has no real roots.

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. Determine the range of values of *m* for which the equation 2*x*2 – *x*(*mx* + 4) = 3 has real and distinct roots.
2. Determine the set of values of *k* for which the equation (2*k* + 3)*x*2 – 3*x* + 1 = 0 has real and distinct roots.
3. Determine the range of value(s) of *m* for which the equation 2*x* – 2*m* + (*m* + *x*)2 = 0 has equal and real roots.
4. Determine the range of values of *p* for which the equation 4*p* + (*p* + 2)*x*2 = (4*p* + 2)*x* has equal and real roots.
5. Determine the range of values of *k* for which the equation (*k* + 3)*x*2 + 4*x* + *k* = 0 has real and distinct roots.

Unit 4 **Equations and Inequalities**

1. Determine the range of values of *m* for which the equation (2*m* – 4)*x* + *mx*2 = 2 – 3*m* has real and distinct roots.

**CLASSWIZ WORKSHEETS**

1. Determine the set of values of *k* for which the equation *k*(*x* – 3) = *x*2 has real and distinct roots.
2. Determine the range of values of *k* for which the equation (8 – 4*k*)*x* + 2*kx*2 + *k* + 1 = 0 has no real roots.
3. Determine the range of values of *a* for which the equation – 3*x* + *a*(*x*2 + 5*x*) = – 4*a* has no real roots.
4. Determine the values of *k* for which the equation (*k* – 5)*x* + 3*kx*2 = 5*x*2 + 2 has equal and real roots.

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. Determine the value(s) of *b* for which the equation *bx* + *x*2 = 3(3 – *b*) has equal and real roots.
2. Determine the range of values of *m* for which the equation 6*x* + 2*mx*2 + *m* = *m*(*x* – 1) has no real roots.
3. The roots of the quadratic equation 8*x*2 – *x* + 2 = 0 are 𝑎and 𝛽. Find a quadratic equation whose roots are 𝑎+ 1 and 𝛽+ 1.
4. The roots of the quadratic equation 3*x*2 + 7*x* + 5 = 0 are 𝑎and 𝛽. Find a quadratic equation whose roots are 𝑎2 and 𝛽2.

Unit 4 **Equations and Inequalities**

1. The roots of the quadratic equation 2*x*2 – 7*x* + 8 = 0 are 2𝑎and 2𝛽. Find a quadratic equation whose roots are 2𝑎2 and 2 𝛽2.

**CLASSWIZ WORKSHEETS**

1. The roots of the quadratic equation 6*x*2 – 2*x* + 3 = 0 are 𝑎+ 1 and 𝛽+ 1. Find a quadratic equation whose roots are *α*2 and 𝛽2.
2. The roots of the quadratic equation 11*x*2 – 8*x* + 13 = 0 are *α* and 𝛽. Find a quadratic equation whose

roots are and .

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

# Level 3

1. Solve the pair of simultaneous equations.

*y* = 2*x*3 – 5*x*2 – *x* + 6

*y* + 6 = 3*x*

1. Solve the pair of simultaneous equations.

5*m* – 3*n* = 12

– = 1

1. Solve the pair of simultaneous equations.

*q*2 = 19*p*2 + *7pq* + 25

7*p* + 4 = *q*

Unit 4 **Equations and Inequalities**

1. Solve the pair of simultaneous equations.

**CLASSWIZ WORKSHEETS**

2*a*2 = *b*2 + *3ab* + 1

*b* + 5*a* = 3

1. Solve the pair of simultaneous equations.

*=*

*y* = 3 + *x*

1. Find the range of values of *k* for which the curve *y* = *x*2 – 4*x* + *k* meets the line *y* = 3*kx* – 4.
2. Given that the line *y* + 2*x* + *m* + 2 = 0 is a tangent to the curve *y* = *mx*2 – 3*mx* + 2, find the values of *m*.

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. The roots of the quadratic equation 5*x*2 + 2*x* + 9 = 0 are *α* and 𝛽. Find a quadratic equation whose roots are *α*3 and 𝛽3.
2. The roots of the quadratic equation 4*x*2 – 16*x* + 25 = 0 are *α*2 and 𝛽2, where *α* + 𝛽> 0 and *α*𝛽> 0. Find a quadratic equation whose roots are *α*3 + 1 and 𝛽3 + 1.
3. Find the range of values of *x* that satisfies the inequality 6 – 2*x* ≤ 2*x*2 – 5*x* + 1 < 17 – *x*.

Unit 4 **Equations and Inequalities**

# Level 4

**CLASSWIZ WORKSHEETS**

1. Show that the quadratic equation *k*(*x*2 – 1) + *x*(*x* – 4) – 3 = 0 has real roots for all real values of *k*.
2. Given that the equation *kx*(*x* + 1) + 3 = *x* – 2*k*, where *k* is a non-zero integer, find the value(s) of *k* for which
   1. one root is negative of the other.
   2. one root is the reciprocal of the other.
   3. one root is twice the other.
3. Find the range of values of *k* if *k*(*x*2 + 1) > 6 – 8*x* for all real values of *x*.

**Casio ClassWiz Mathematics Workbook**

**CLASSWIZ WORKSHEETS**

1. Find the range of values of *k* for which (*k* – 3)*x*2 + 4*x* + *k* is always positive for all real values of *x*.
2. (a) Show that the line *y* = 8*x* – 9 is a tangent to the curve *y* = 16*x*2 – 16*x*.

(b) By finding the condition for *y* = *mx* – *c*2, where *m* > 0 and *c* > 0, to be a tangent to the curve *y* = 16*x*2 – 16*x*, show that *m* = 8*c* – 16.

1. A boy threw a basketball off a building such that the height, *h* m, of the ball above the ground level *t*

seconds later is given by *h* = *t* (45 – *t*). Find the range of values of *t* for which the ball is at least 100m

above the ground level