DISCRIMINANT PRACTICE
Question 1 (**)

The quadratic equation

\[ x^2 + 10x + k = 0, \]

where \( k \) is a constant, has no real roots.

Find the range of the possible values of \( k \).

\[ k > 25 \]

Question 2 (**)

It is given that

\[ f(x) = 25x^2 + 20x + p, \]

where \( p \) is a non-zero constant.

The quadratic equation \( f(x) = 0 \) has equal roots.

Find the value of \( p \).

\[ p = 4 \]
Question 3 (***)
The quadratic equation
\[ mx^2 + 12x + m = 0, \]
where \( m \) is a constant, has repeated roots.
Find the possible values of \( m \).

\[ m = \pm 6 \]

Question 4 (***)
The quadratic equation
\[ 3x^2 + 2x + p = 0, \]
where \( p \) is a constant, has two distinct real roots.
Find the range of possible values of \( p \).

\[ p < \frac{1}{3} \]
Question 5 (**)

The quadratic equation

\[ x^2 + 3x + m = 0, \]

where \( m \) is a constant, has no real roots.

Find the range of possible values of \( m \).

\[ m > \frac{9}{4} \]

Question 6 (**)

Find the range of the possible values of the constant \( p \), given that the equation

\[ px^2 - 5x + 5 = 0 \]

has real roots.

\[ p \leq \frac{5}{4} \]
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**Question 7 (**)**

The quadratic equation

\[ x^2 + kx + 4 = 0, \]

where \( k \) is a constant, has no real roots.

Find the range of possible values of \( k \).

\[ -4 < k < 4 \]

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**Question 8 (**)**

Find the range of the possible values of the constant \( p \), given that the equation

\[ x^2 + 5px + 2p = 0 \]

has real roots.

\[ , p \leq 0 \text{ or } p \geq \frac{8}{25} \]
Question 9 (**+)

\[ f(x) \equiv 9x^2 - 6x + c, \]

where \( c \) is a non-zero constant.

The equation \( f(x) = 0 \) has equal roots.

a) Determine the value of \( c \).

b) Solve the equation \( f(x) = 0 \) for the value of \( c \) found in part (a).

\[ c = 1, \quad x = \frac{1}{3} \]

Question 10 (**+)

\[ f(x) \equiv x^2 + kx + 1, \]

where \( k \) is a constant.

The equation \( f(x) = 0 \) has no real roots.

Determine the range of the possible values of \( k \).

\[ -2 < k < 2 \]
Question 11  (**+)**

The equation $3x^2 + 5x + c = 0$, where $c$ is a constant, has equal roots.

a) Determine the value of $c$.

b) Solve the equation

$$3x^2 + 5x + c = 0.$$ 

$$c = \frac{25}{12}, \quad x = -\frac{5}{6}$$

Question 12  (**+)**

It is given that $f(x) = x^2 - 2mx + 16$, where $m$ is a constant.

The equation $f(x) = 0$ has two distinct real roots.

Determine the range of values of $m$.

$m < -4$ or $m > 4$
Question 13 (**+)  
It is given that  
\[ f(x) = x^2 + kx + k , \]
where \( k \) is a constant.  
The equation \( f(x) = 0 \) has two distinct real roots.  
Determine the range of the possible values of \( k \).  
\[ k < 0 \text{ or } k > 4 \]

Question 14 (**+)  
The quadratic equation  
\[ x^2 + 3mx + m = 0 , \]
where \( m \) is a constant, has real roots.  
Find the range of possible values of \( m \).  
\[ m \leq 0 \text{ or } m \geq \frac{4}{9} \]
Question 15  (***)
The quadratic equation

\[ x^2 - 8x + k = 0, \]

where \( k \) is a constant, has equal roots.

Solve the equation

\[ x^2 - 8x + k = 0. \]

\[ x = 4 \]

Question 16 (***)
Find the range of the values of the constant \( p \), given that the quadratic equation

\[ x^2 - px + 9 = 0 \]

has no real roots.

\[ -6 < p < 6 \]
Question 17 (***)
Find the range of values of the constant $p$ so that the quadratic equation

$$2x^2 - 4x - (2p + 1) = 0$$

has no real roots.

$$p < -\frac{3}{2}$$

Question 18 (***)
Find the range of values of the constant $k$ so that the quadratic equation

$$x^2 + 6kx - 2k = 0$$

has real roots.

$$k \leq \frac{-2}{3} \text{ or } k \geq 0$$
Question 19  (***)

It is given that

\[ f(x) = x^2 - kx + (k + 3), \]

where \( k \) is a non-zero constant.

If the equation \( f(x) = 0 \) has real roots find the range of the values of \( k \).

\[ k \leq -2, \quad k \geq 6 \]

Question 20  (***)

Find the range of values of the constant \( p \) so that the quadratic equation

\[ (3p - 2)x^2 + 8x + p = 0, \quad p \neq \frac{2}{3} \]

has no real roots.

\[ p < -2 \text{ or } p > \frac{8}{3} \]
Question 21 (***)
The quadratic equation
\[ x^2 + (k - 1)x + (k + 2) = 0, \]
where \( k \) is a constant, has no real roots.

Find the range of possible values of \( k \).

\[ -1 < k < 7 \]

Question 22 (***)
\[ f(x) = x^2 + (1 - p)x + 4, \]
where \( p \) is a non zero constant.

The equation \( f(x) = 0 \) has equal roots.

a) Determine the possible values of \( p \).

b) Solve the equation \( f(x) = 0 \) for each of the values of \( p \) found in part (a).

\[ p = -3, 5, x = \pm 2 \]
Question 23 (***)

\[ f(x) = (k-1)x - 2 - 8x^2, \]

where \( k \) is a non zero constant

The equation \( f(x) = 0 \) has equal roots.

Determine the possible values of \( k \).

\[ k = -7, 9 \]

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Question 24 (***)

The quadratic equation

\[ x^2 + kx + 2 = 0, \]

where \( k \) is a constant, has no real roots.

Find, as exact surds, the range of values of \( k \).

\[ -\sqrt{8} < k < \sqrt{8} \]
**Question 25  (***)**

The quadratic equation

\[ 2x^2 + (3k - 1)x + (3k^2 - 1) = 0, \]

where \( k \) is a constant, has two different real roots.

Find the range of values of \( k \).

\[ -1 < k < 3 \]

**Question 26  (***)**

Find the range of values of the constant \( m \) so that the quadratic equation

\[ x^2 + (m+3)x + (3m+4) = 0 \]

has two distinct real roots.

\[ m < -1 \text{ or } m > 7 \]
Question 27 (***)
Find the range of values of the constant $k$ so that the quadratic equation
\[ x^2 + (2k + 1)x + k^2 = 2 \]
has real roots.

\[ k \geq -\frac{9}{4} \]

Question 28 (***)
Find the range of values of the constant $p$ so that the quadratic equation
\[ x^2 + 2px + (2p + 8) = 0 \]
has real roots.

\[ p \leq -2 \text{ or } p \geq 4 \]
Question 29 (***)

The quadratic equation

\[ mx^2 + 2(m+1)x + 4 = 0, \]

where \( m \) is a constant, has equal roots.

Find the possible value of \( m \).

Question 30 (***)

The quadratic equation

\[ (m+1)x^2 + 12x + (m-4) = 0, \]

where \( m \) is a constant, such that \( m \neq -1 \), has two distinct real roots.

Determine the range of possible values of \( m \).
Question 31  (***)
Find the possible range of the values of the non zero constant \( k \), so that the quadratic equation

\[ kx^2 - x + (3k - 1) = 0 \]

has distinct real roots.

\[ -\frac{1}{6} < k < \frac{1}{2}, \quad k \neq 0 \]

Question 32  (***)
The quadratic equation

\[ x^2 + 2mx + 3m + 4 = 0, \]

where \( m \) is a constant, has equal roots.

Find the possible values of \( m \).

\[ m = -1, 4 \]
Question 33 (***)

The quadratic equation

\[ mx^2 - 4x + m - 3 = 0, \]

where \( m \) is a non-zero constant, has repeated roots.

a) Find the possible values of \( m \).

b) Hence solve the equation for each value of \( m \) found in part (a).

\[ m = -1, 4, \quad x = -2, \frac{1}{2} \]

Question 34 (***)

Find the range of the possible values of the constant \( m \), given that the equation

\[ 4x^2 + 4x(m - 1) + 9 = 0 \]

has real roots.

\[ m \leq -2 \quad \text{or} \quad m \geq 4 \]
Question 35  (***)
Find the range of values of the non zero constant $k$, given that the quadratic equation
$$2kx^2 + (k-1)x + k = 1$$
has distinct real roots.

$$\frac{-1}{7} < k < 1, \ k \neq 0$$

Question 36  (***)
Find the range of values of the constant $m$ so that the quadratic equation
$$mx^2 - x + m = 0$$
has real roots.

$$-\frac{1}{2} \leq m \leq \frac{1}{2}$$
Question 37  (***)
Find the range of the possible values of the constant $k$, $k \neq -2$, so that the quadratic equation

$$2(k+2)x^2 + (k+1)x + (k+1) = 0$$

has no real roots.

\[ k < -\frac{15}{7} \text{ or } k > -1 \]

Question 38  (****)

$$f(x) = x^2 + 2(2p-1)x + 7p + 4,$$

where $p$ is a constant.

The equation $f(x) = 0$ has no real roots.

Determine the range of the possible values of $p$.

\[ -\frac{1}{4} < p < 3 \]
Question 39 (****)
Find the range of values of the non zero constant $k$ so that the quadratic equation

$$2kx^2 + 4x + k - 1 = 0$$

has two distinct real roots.

$$-1 < k < 2, k \neq 0$$

Question 40 (****)
Find the range of values of the constant $p$, $p \neq -2$, so that the quadratic equation

$$(p + 2)x^2 + 4x + p + 5 = 0$$

has no real roots.

$$p < -6 \text{ or } p > -1$$
Question 41  (****)

Find the range of values of the non zero constant $m$ so that the quadratic equation

$$mx^2 + (2m - 3)x + 2m + 1 = 0$$

has two distinct real roots.

$$-\frac{9}{2} < m \leq \frac{1}{2}, \ m \neq 0$$

Question 42  (****)

$$f(x) = x^2 + (3 - k)x + 5 - k^2$$

where $k$ is a constant.

a) Given that the equation $f(x) = 0$ has equal roots, find the possible values of $k$.

b) Solve the equation $f(x) = 0$, for each value of $k$ found in part (a)

$$k = -1, -\frac{14}{5}, \ k = -2, -\frac{3}{5}$$
Question 43 (****)

\[ f(x) = x^2 - 2mx - 5, \] where \( m \) is a constant.

a) Without attempting a solution, show that the equation \( f(x) = 0 \) has two distinct real roots for all possible values of the constant \( m \).

b) Find, in terms of \( m \) and in fully simplified form, the roots of the equation

\[ f(x) = 0. \]

\[ x = m \pm \sqrt{m^2 + 5} \]
Question 44 (***)

The quadratic equation

$$kx^2 - 4x + k - 3 = 0,$$

where $k$ is a non-zero constant, has equal roots.

a) Determine the possible values of $k$.

b) Solve the equation for each value of $k$ found in part (a).

$$k = -1, 4, \quad x = -2, \frac{1}{2}$$
Question 45 (****)

The quadratic equation

$$4x^2 + (16 - p)x + 13 = p,$$

where $p$ is a constant, has equal roots.

a) Determine the possible values of $p$.

b) Solve the equation for each of the values of $p$ found in part (a).

$$p = 4, 12, \quad x = -\frac{3}{2}, -\frac{1}{2}$$
Question 46  (***)

The quadratic equation

\[ 3(k+2)x^2-(5k+7)x+3k+1=0, \]

where \( k \) is a constant, \( k \neq -2 \), has two distinct real roots.

Show clearly that

\[ \frac{25}{11} < k < 1. \]

Question 47  (***)

\[ f(x) = m(1-x)-x^2, \] where \( m \) is a constant.

The equation \( f(x) = 0 \) has no real roots.

Determine the range of the possible values of \( m \).

\[ -4 < m < 0 \]
A curve $C$ has equation

$$y = x^2 + 2mx + (3m + 4),$$

where $m$ is a real constant.

The graph of $C$ touches the $x$ axis.

a) Determine the possible values of $m$.

b) For each value of $m$ found in part (a), find the $x$ coordinate of the point where the graph of $C$ touches the $x$ axis.

$\therefore, m = -1, 4 \quad \therefore x = -2, 1$
Question 49  (****)
The quadratic equation
\[ 3(p+2)x^2 + (p+5)x + p = 0, \]
where \( p \) is a constant, \( p \neq -2 \), has repeated roots.
Find the possible roots of the equation.

\[ x = -\frac{1}{3}, \ x = \frac{5}{3} \]

Question 50  (****)
The quadratic equation, where \( m \) is a constant,
\[ x^2 + 2mx + 3x + m^2 = 0, \]
has equal roots.
Find the value of \( m \).

\[ m = -\frac{3}{4} \]
Question 51 (****)
The quadratic equation

\[ k(x^2 + 1) - 3x + 4 = 0, \]

where \( k \) is a non zero constant, has real roots.

Find the range of possible values of \( k \).

\[ -\frac{9}{2} \leq k \leq \frac{1}{2} \]
Question 52 (****+)

Find the range of values of the non zero constant $k$, given that the quadratic equation

$$3kx^2 - 2kx - 4x + 3 = 0$$

has two different real roots.

$k < 1$ or $k > 4, \quad k \neq 0$
Question 53  (**4+)**

It is given that

\[ f(x) = x^2 + 2x - m(x^2 - 2x + 2) - 2, \]

where \( m \) is a constant such that \( m \neq 1 \).

The equation \( f(x) = 0 \) has distinct real roots.

Determine the range of values of \( m \).

\[ -1 < m < 3, \ m \neq 1 \]