1.1.1 \( 3x^2 - 7x = 0 \)
\( x(3x - 7) = 0 \)  
\( x = 0 \) or \( x = \frac{7}{3} \)  
\( x \)-value \( \text{factors} \)  
(2)

1.2 \( 5x^2 = 3x + 6 \), \( 5x^2 - 3x - 6 = 0 \)  
\( a = 5 \), \( b = -3 \), \( c = -6 \)  
\( n = -\frac{b \pm \sqrt{b^2 - 4ac}}{2a} \)  
\( x = -\frac{-3 \pm \sqrt{(-3)^2 - 4(5)(-6)}}{2(5)} \)  
\( x = 3 \pm \sqrt{129} \) \( \frac{10}{\sqrt{129}} \)  
\( x = -0.84 \) or \( x = 1.44 \)  
\( \text{x-values} \) (4)

1.4 \( 3x^3 - 13x^2 + 10 = 0 \)  
\( (3x^2 + 2)(x - 5) = 0 \)  
\( \frac{1}{3} = k \)  
\( 3^2 - 13k - 10 = 0 \)  
\( 3k + 2 \) \( k - 5 \)  
\( x^3 = \frac{-2}{3} \) or \( x^3 = 5 \) \( \text{both} \)  
\( x = \frac{-2}{3} \) or \( x = 125 \)  
\( \text{ans} \) (4)

1.13 \( \sqrt{2-x} - 4 = x \)  
\( \sqrt{2-x} = x + 4 \)  
\( (\sqrt{2-x})^2 = (x+4)^2 \) \( \text{Square} \)  
\( 2-x = x^2 + 8x + 16 \)  
\( x^2 + 8x + x + 16 - 2 = 0 \)  
\( x^2 + 9x + 14 = 0 \) \( \text{facors} \)  
\( (x+2)(x+7) = 0 \) \( \text{factors} \)  
\( x = -2 \), \( x = -7 \)  
\( \text{concl} \) (4)

1.5 \( 4^{x+1} + 5.2^x = 6 \)  
\( 4^{x+2} + 5.2^x - 6 = 0 \)  
\( 2^{2x} \cdot 2^2 + 5.2^x - 6 = 0 \)  
\( 4 \cdot 2^x + 5.2^x - 6 = 0 \)  
\( \text{let} \ k = 2^x \) \( k^2 = 2 \) \( 4k^2 + 5k - 6 = 0 \)  
\( (4k - 3)(k + 2) = 0 \) \( \text{facors} \)  
\( k = \frac{3}{4} \) \( \text{or} \ k = -2 \) \( \text{both} \)  
\( 2k = \frac{3}{4} \) \( \text{or} \ 2^x = -2 \) \( \text{concl} \)  
\( x = \frac{-\log 3}{\log 2} \) \( \text{solve loga} \) \( \text{no soln} \) \( \text{ans} \)  
\( = -0.42 \) \( \text{ans} \)  
(7)
1.6 \(2x^2 - 7x - 15 \geq 0\) 
\((2x+3)(x-5) > 0\)

Critical values: \(x = \frac{-3}{2}\) or \(x = 5\)

\[x \leq \frac{-3}{2}\] or \(x \geq 5\)

2.1 \(a - b = -\frac{9}{\alpha}\)

\(\text{LCD} = \alpha^2\) (\(\alpha \neq 0\))

\[a^2 - 6a = -9\]

\[a^2 - 6a + 9 = 0\]  \(\text{std form}\)

\((a - 3)(a - 3) = 0\)

\[a = 3\]  \(\text{ans}\)

2.2 \(2x^2 + x = 3\)

\[2x^2 + x - 3 = 0\]  \(\text{std form}\)

\[(x-1)(2x+3) = 0\]  \(\text{factor}\)

\(x = 1\) or \(x = \frac{-3}{2}\)  \(\text{ans}\)

1.3 \(2x^2 - 3xy = -4\) and \(4 = 2x + y\)

\[y = 4 - 2x\]

\[2x^2 - 3x(4-2x) = -4\]

\[2x^2 - 12x + 6x^2 = -4\]

\[8x^2 - 12x + 4 = 0\]  \(\div 4\)

\[2x^2 - 3x + 1 = 0\]

\[(2x-1)(x-1) = 0\]

\[x = \frac{1}{2}\] or \(x = 1\)  \(\text{both x's}\)

\(y = 4 - 2(\frac{1}{2})\)  \(\text{or}\) \(y = 4 - 2(1)\)

\(y = 3\)  \(\text{and}\) \(y = 2\)  \(\text{both y's}\)

1.4 \[\frac{2018}{3^{2018}} + \frac{3}{3^{2018} + 3^{2017}} = \frac{3^{2017} + 1}{3^{2017} + 3^{2018}}\]

\[= \frac{3^{2017}}{3^{2017} \cdot 3^2 + 3^{2017}}\]

\[= \frac{3^{2017} \cdot 3}{3 \cdot (3^2 + 1)}\]

\[= \frac{3}{10}\]  \(\text{correct}\)
Question 3

\[ 3x^2 - 2x - 7 = 0 \]

\[ \Delta = b^2 - 4ac \]
\[ \Delta = (-2)^2 - 4(3)(-7) \]
\[ \Delta = 4 + 84 \]
\[ \Delta = 88 \]

\[ \Delta > 0 \text{ real roots, } \Delta \neq 0 \text{ unequal roots, } \Delta = 0 \text{ equal roots} \]

roots are real, irrational and unequal.

\[ \frac{5}{5} \]
\[ (3\sqrt{5} + 1)^2 \]
\[ \frac{15\sqrt{5}}{5} + 5 \]

Question 2

\[ \sqrt{98} \left( \sqrt{32} - \sqrt{18} \right) \]
\[ = \sqrt{49 \times 2} \left( \sqrt{16 \times 2} - \sqrt{9 \times 2} \right) \]
\[ = 7 \sqrt{2} \left( 4\sqrt{2} - 3\sqrt{2} \right) \]
\[ = 7 \sqrt{2} \times 2 \]
\[ = 14 \]

Question 1

\[ 2x^3 - 3x^2 - 2x \]
\[ = -\frac{2}{x} - 2\sqrt{x} \]
\[ = \frac{6x - 2x \sqrt{x} - 2 \sqrt{x}}{x} \]
\[ = -\frac{2}{x} - 2\sqrt{x} \]

\[ (5 - 2\sqrt{3})^2 = (5 - 2\sqrt{3}) \times (5 - 2\sqrt{3}) \]
\[ = 25 - 20\sqrt{3} + 12 \]
\[ = 37 - 20\sqrt{3} \]

\[ \frac{15 + \sqrt{5}}{\sqrt{5}} \]
\[ = \frac{15\sqrt{5} + 5}{5} \]
\[ = \frac{15\sqrt{5}}{5} + 1 \]
4x - 5 = p(x^2 - 1), \ p \neq 0

4x - 5 = px^2 - p

px^2 - 4x + 5 - p = 0

for equal roots \ \Delta = 0

\therefore b^2 - 4ac = 0

(4)^2 - 4(-p)(-5+p) = 0 \quad \text{sub into } \Delta

16 + 4p(-5+p) = 0

16 - 20p + 4p^2 = 0

4p^2 - 20p + 16 = 0

p^2 - 5p + 4 = 0 \quad \checkmark

(p-4)(p-1) = 0 \quad \checkmark

p = 4 \quad \text{or} \quad p = 1 \quad \checkmark

(5)

3.3. \ x^2 - 5 = 2x + k.

\begin{align*}
\Delta &= (-2)^2 - 4(1)(-5-k) \quad \checkmark \\
&= 4 + 20 + 4k \\
&= 4k + 24
\end{align*}

for no intersection

\begin{align*}
\Delta &< 0 \\
4k + 24 &< 0 \quad \checkmark
\end{align*}

k < -6 \quad \checkmark

(4)
Question 4

$\text{p} - 4, 11 - p, q + p - 22, 22 - q$

$p - 4 = 11 - p$, $q + p - 22 = 22 - q$

$p - 4 = 11 - p$, $q + p - 22 = 22 - q$

$p - 4 = 11 - p$, $q + p - 22 = 22 - q$

$p - 4 = 11 - p$, $q + p - 22 = 22 - q$

$p = 7$ and $q = 16$ are used.
12. \[ g(x) = 2 \left( \frac{1}{3} \right)^{x-1} + 1 \]

Station: 2 units right, 3 units down.

\[ y = 2 \left( \frac{1}{3} \right)^{x-1} - 1 \]

\[ y = 2 \left( \frac{1}{3} \right)^{x-1} + 1 \]

Second point: \( x = 1, y = 2 \left( \frac{1}{3} \right)^{1-1} + 1 \)

5.4

5.5

5.1 Horizontal asymptote

\[ y = 2 \left( \frac{1}{3} \right)^{0} + 1 \]

\[ y = 7 \]

\[ y = 2 \left( \frac{1}{3} \right)^{x-1} + 1 = 0 \]

\[ (\frac{1}{3})^{x-1} = -\frac{1}{2}, \text{ no soln.} \]

y-intercept: let \( x = 0 \)

13. \( y < 1 \) or \( y > 1 \)
Question 6

6.1.1. $x \in \mathbb{R}, x \neq 2$.

6.1.2. (a) $y = -\left(\frac{x^2 - 2}{x - 2}\right)$

6.1.3. $-9x - 2 = -x^2 + 2x + 4(x - 2) - 7(x - 2)$

6.1.4. $y = \frac{1}{x - 2} - 1$

6.1.5. $\frac{9}{x - 2} = \frac{3}{x - 2}$

6.1.6. (1) $A(2, \frac{2}{3})$

6.1.7. $B(-1, 0)$

6.1.8. $C(3, -1)$

6.1.9. $x = 3$ or $x \neq 3$.
Question 7:

\[ f(-1) = -(-1)^3 + 7 \]
\[ = \frac{8}{8} \checkmark \]

\[ f(2) = -(2)^3 + 7 \]
\[ = -1 \checkmark \]

Average grad = \[ \frac{8 - (-1)}{-1 - 2} \]
\[ = \frac{9}{-3} \]
\[ = -3 \] \( (3) \)

Total 100 Marks