KME272 - Assesment 1.1

[2024-08-02 Fri 21:46]

Contents

1   Q1

1.1   (i)

$$2x^2 - 150x = 0$$
$$x(2x - 150) = 0$$
$$x = 0 \text{ or } 2x - 150 = 0$$
$$x = 0 \text{ or } x = 75$$

1.2   (ii)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-150 \pm \sqrt{150^2 - 4 \cdot 2 \cdot 3}}{2 \cdot 2}$$
$$x = 74.97999466 \text{ or } 20.00533618 \cdot 10^3$$

1.3 (iii)

digits of precision	$b^2 - 4ac$	$\sqrt{b^2 - 4ac}$	$x_2 = \frac{-b-\sqrt{b^2-4ac}}{2a}$
1	40000	200	0
2	22000	150	0.0
3	22500	150	0.00
4	22480	149.9	0.02500
5	22476	149.92	0.020000
6	22476	149.920	0.0200000

Calculation for two digits of precision with rounding up:

$$
\begin{array}{|l|l|l|}
=b^2 - 4ac & =\sqrt{b^2 - 4ac} & x_2 = \frac{-b-\sqrt{b^2-4ac}}{2a} \\
=150^2 - 4 \cdot 2 \cdot 3 & =\sqrt{22000} & x_2 = \frac{150-150}{2\cdot 2} \\
=22476 & =148.324 & x_2 = 0 \\
=22000 & =150 & x_2 = 0.0
\end{array}
$$

1.4 (iv)

Catastrophic occurs when two numbers are cloes to one another and are subtracted, resulting in a small number. So, for (4) to be accurate and (3) inaccurate we must have the value of $-4ac$ being small relatvie to b^2 and $b < 0$ to get $-b+\sqrt{b^2 - 4ac} \approx -b+b$ and $-b-\sqrt{b^2 - 4ac} \approx -b-b \approx -2b$. And for (3) to be accurate and (4) inaccurate we must have the same situation, but $b > 0$, as it would lead to $b-\sqrt{b^2 - 4ac} \approx b-b$ and $b+\sqrt{b^2 - 4ac} \approx b+b \approx 2b$.

1.5 (v)

digits of precision	$x_1 = \frac{(-b+\sqrt{b^2-4ac})}{2a}$	$x_2 = \frac{c}{ax_1}$
1	100	0.02
2	75	0.020
3	75.0	0.0200
4	74.97	0.02001
5	74.980	0.020005
6	74.9800	0.0200053