Q4) By using $f(x) = (x-1)(x-2)\ldots(x-30)$, I got overflow for these 30 roots.

Q5) (i) $1.3214 + 1.937$

error in 1st number is 0.00005

and " " 2nd " " 0.0005

so, bound is $(1.32135 + 1.9365, 1.32145 + 1.9375)$

$= (3.25785, 3.25845)$

(ii) $2.026 - 1.86$

error in 1st number is 0.0005

" " 2nd " " 0.005

so, bound is $(2.0255 - 1.865, 2.0265 - 1.855)$

$= (0.1605, 0.1715)$

(iii) 2.321×6.31

error in 1st number is 0.0005

" " 2nd " " 0.005

Bound is, $(2.3205 \times 6.305, 2.3215 \times 6.315)$

$= (14.631, 14.66)$

actual result got= (14.6307525,14.6602725)

(iv) $\frac{6.354}{0.034}$

error in 1st & 2nd number is 0.0005

Bound is $\left(\frac{6.3535}{0.0345}, \frac{6.3545}{0.0335}\right) = (184.16, 189.68)$

actual result got= (184.1594202898 6,189.68656716418)

(v) $1/0.8764$

error in denominator $\rightarrow 0.00005$

so, bound $= \left(\dfrac{1}{0.87645}, \dfrac{1}{0.87635} \right)$

$= (1.1409, 1.1411)$

(vi) $\dfrac{1}{0.0012}$

error in denominator is $\rightarrow 0.00005$

so, bound $= \left(\dfrac{1}{0.00125}, \dfrac{1}{0.00115} \right)$

$= (800, 869.57)$

(vii) $(2.23)^{0.432}$

error in 2.23 is 0.005

" " 0.432 is 0.0005

so, bound $= \left(\cancel{2.235^{0.4325}}, \cancel{2.225} \right)$

$= \left(2.225^{0.4315}, 2.235^{0.4325} \right)$

$= (1.4121, 1.416)$

(viii) $\tan(1.57)$

error in 1.57 is 0.005

so, bound $= (\tan(1.565), \infty)$ and $(-\infty, \tan(1.575))$

$= (172.52, \infty)$ and $(-\infty, -237.88)$

(ix) $e^{3.14}$

error in 3.14 is 0.005

so, bound $= \left(e^{3.135}, e^{3.145} \right)$

$= (22.988, 23.220)$

(6) $\underline{10^{32} + 272 - 10^{32}}$

10^{32} can be written as $10^{32} = 2^{107} \times \{$ some fractional part

and $272_{10} = (\underbrace{000100010000}_{9 \text{ places}})_2$

1 0 0 0 1 0 0 0 0

99 100 103 104 105 106 107

These last 9 bits is going to changed under the above operation. For n-bit fractional part computers if $n < 98$. then the value of the operation will be 0 as these 9 bits of 272 are not going to be considered. If $99 \leq n \leq 102$ ~~$n = 99$~~ then 1 at 99-bit place will be considered so result will be. $2^8 = 256$ and if $n \geq 103$ then both 1 of 272_{10} is going to be considered so, value will be $2^8 + 2^4 = 272$.

According to this logic,

For bit	Value of the expression
48-bit	0
96-bit	0
100-bit ($99 \leq n \leq 102$)	256
104-bit ($n \geq 103$)	272
108-bit (")	272

Minimum size of the fraction part needed to give the correct result is 103.

7 (i) $x(1-x)$

Error due to uncertainity in x is.

$$\epsilon x \times \frac{d}{dx}(x(1-x)) = \epsilon x(1-2x)$$

substracting x from 1 is going to give some error say ϵ_0, so the result is

$$(1-x)(1+\epsilon_0)$$

Again we are multiplying by x which gives another error say ϵ_0' so, the result is

$$x(1-x)(1+\epsilon_0)(1+\epsilon_0') \simeq x(1-x)(1+\epsilon_0+\epsilon_0'+\epsilon_0\epsilon_0')$$

$$\simeq x(1-x)+E_n$$

this ~~ten~~ term can be ignored.

where $|E_n| < 1.06 \times 2\hbar |x(1-x)|$

$$< 2.12\hbar |x(1-x)|$$

(ii) $\sqrt{1+4x^2}$

Error due to uncertainity in x is

$$\epsilon x \times \frac{d}{dx}(\sqrt{1+4x^2}) = \epsilon x\left(\frac{\cancel{8}^{4}x}{\cancel{2}\sqrt{1+4x^2}}\right)$$

$$= \frac{4\epsilon x^2}{\sqrt{1+4x^2}}$$

(iii) $\sqrt{1+4x^2}+10-2x$

Error due to uncertainity in x is

$$\epsilon x \times \frac{d}{dx}\left(\sqrt{1+4x^2}+10-2x\right) = \epsilon x\left(\frac{4x}{\sqrt{1+4x^2}}-2\right)$$

$$\text{Error} = 2\epsilon x\left(\frac{2x}{\sqrt{1+4x^2}}-1\right)$$