

Q4) By using $f(n) = (n-1)(n-2)\dots(n-30)$, 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 $(1.32145 + 1.9365, 1.32145 + 1.9375)$

$$= (\text{~~2.005~~ } 3.25785, 3.25895)$$

(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) 6.354

0.034

error in 1st & 2nd number is 0.0005

$$\text{Bound is } \left(\frac{6.3535}{0.0345}, \frac{6.3545}{0.0335} \right) = (184.16, 189.69)$$

actual result got = (184.15942028986, 189.68656716418)

(v) $\frac{1}{0.8764}$

error in denominator $\rightarrow 0.00005$

so, bound = $\left(\frac{1}{0.87645}, \frac{1}{0.87635} \right)$
 $= (1.1409, 1.1411)$

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

error in denominator is $\rightarrow 0.00005$

so, bound = $\left(\frac{1}{0.00125}, \frac{1}{0.00115} \right)$
 $= (800, 869.57)$

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

error in 2.23 is 0.005
 " " 0.432 is 0.0005

so, bound = $\left(\cancel{2.235^{0.4325}}, \cancel{2.225^{0.4325}} \right)$
 $= (2.225^{0.4315}, 2.235^{0.4325})$
 $= (1.4121, 1.416)$

(viii) $\tan(1.57)$

error in 1.57 is 0.005

so, bound = $\left(\tan(1.565), \infty \right)$ and $\left(-\infty, \tan(1.575) \right)$
 $= (172.52, \infty)$ and $(-\infty, -237.88)$

(ix) $e^{3.14}$

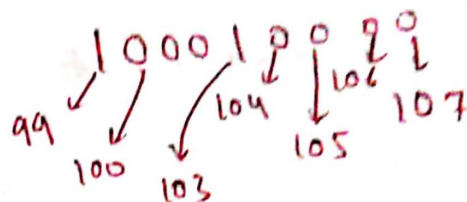
error in 3.14 is 0.005

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 $10^{32} = 2^{107} \times \{ \text{some fractional part} \}$

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



These last 9 bits is going to be 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 $99 \leq n \leq 102$, then ϕ 1 at 99-bit place will be considered so result will be $2^8 = 256$ and if $n > 103$, then both 1 of 272_{10} is going to be considered so, value will be $2^8 + 2^4 = 272$.

According to this logic,

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

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

⑦ ① $n(1-n)$

Error due to uncertainty in n is.

$$\epsilon_n \times \frac{d}{dn}(n(1-n)) = \epsilon_n (1-2n)$$

Subtracting n from 1 is going to give some error say ϵ_0 , so the result is

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

Again we are multiplying by n which gives another error say ϵ'_0 so, the result is

$$n(1-n)(1+\epsilon_0)(1+\epsilon'_0) \approx n(1-n)(1+\epsilon_0+\epsilon'_0+\epsilon_0\epsilon'_0)$$

$$\approx n(1-n) + E_n$$

this ~~term~~ can be ignored.

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

$$< 2.12 n |n(1-n)|$$

⑧ ② $\sqrt{1+4n^2}$



Error due to uncertainty in n is

$$\epsilon_n \times \frac{d}{dn}(\sqrt{1+4n^2}) = \epsilon_n \left(\frac{4n}{2\sqrt{1+4n^2}} \right)$$

$$= \frac{4\epsilon_n^2}{\sqrt{1+4n^2}}$$

⑨ ③ $\sqrt{1+4n^2} + 10 - 2n$

Error due to uncertainty in n is

$$\epsilon_n \times \frac{d}{dn}(\sqrt{1+4n^2} + 10 - 2n) = \epsilon_n \left(\frac{4n}{\sqrt{1+4n^2}} - 2 \right)$$

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