1. (a) Standard Form $= (0\cdot111)_2 \times 2^4 = (14)_{10}$

Normalized " $= (1\cdot111)_2 \times 2^4 = (30)_{10}$

Denormalized " $= (0\cdot1111)_2 \times 2^4 = (15)_{10}$

(b) Standard Form $: (0\cdot100)_2 \times 2^{-2} = (0\cdot125)_{10}$

Normalized " $= (1\cdot000)_2 \times 2^{-2} = (0\cdot25)_{10}$

De " " $= (0\cdot1000)_2 \times 2^{-2} = (0\cdot125)_{10}$

(c) If the system has negative support,

	Maximum	Minimum
C-1:	$(0\cdot111)_2 \times 2^4 = (14)_{10}$	$-(0\cdot111)_2 \times 2^4 = -(14)_{10}$
C-2:	$(1\cdot111)_2 \times 2^4 = (30)_{10}$	$-(1\cdot111)_2 \times 2^4 = -(30)_{10}$
C-3:	$(0\cdot1111)_2 \times 2^4 = (15)_{10}$	$-(0\cdot1111)_2 \times 2^4 = -(15)_{10}$

2. Consider the **real number x =** $(6.235)_{10}$

2. (a) $x = (6.235)_{10}$

$(6)_{10} = (110)_2$

$(0.235)_{10} = (001111000)_2$

$\therefore (6.235)_{10} = (110.001111000)_2$

	0.235 $\times 2$
0	$.47$ $\times 2$
0	$.94$ $\times 2$
1	$.88$ $\times 2$
1	$.76$ $\times 2$
1	$.52$ $\times 2$
1	$.04$

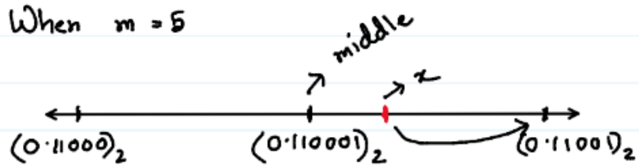
(b) $(6.235)_{10} = (110.001111000)_2$

1	$.52$ $\times 2$
1	$.04$ $\times 2$
0	$.08$ $\times 2$
0	$.16$ $\times 2$
0	$.32$

(b) $(6.235)_{10} = (110.001111000)_2$

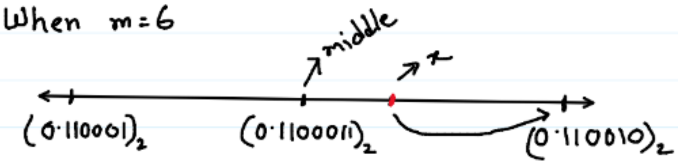
$= (0.\underbrace{11000}_{m=5}1111000)_2 \times 2^3$

When $m = 5$



$\therefore fl(x) = (0.11001)_2 \times 2^3 = (6.25)_{10}$

When $m = 6$



$\therefore fl(x) = (0.110010)_2 \times 2^3 = (6.25)_{10}$

(c) For both $m=5$ and $m=6$, $fl(x) = (6.25)_{10}$

$$\delta = \left|\frac{fl(x) - x}{x}\right| = \left|\frac{6.25 - 6.235}{6.235}\right| = 2.41 \times 10^{-3} \text{ (approx.)}$$

3.(a) $2x^2 - 60x + 3 = 0$

$\Rightarrow x^2 - 30x + \frac{3}{2} = 0$

$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Here,
$a = 1$
$b = -30$
$c = 3/2$

Solving,

$x_1 = \frac{30 + \sqrt{894}}{2} = 15 + 14.9499$ [upto 6 s.f.]

$= 29.9499$

$x_2 = \frac{30 - \sqrt{894}}{2} = 15 - 14.9499$

$= 0.0501000$ [upto 6.sf]

Now, $x_1 \times x_2 = 29.9499 \times 0.0501000 = 1.50048$ [upto 6sf]

$\therefore x_1 \times x_2 \neq 1.5$

So, when roots are multiplied, loss of significance occours. as we subtracted two close numbers.

(b) $x_1 + x_2 = 29.9499 + 0.0501000$

$= 30$

$\therefore x_1 + x_2 = -b/a$

$x_1 \times x_2 = 29.9499 \times 0.0501000$

$= 1.50048$

$\therefore x_1 x_2 \neq c/a$

(c) $x_1 \times x_2 = c/a$

$\Rightarrow 29.9499 \times x_2 = 1.5$

$\Rightarrow x_2 = \frac{1.5}{29.9499} = 0.0500836$ [upto 6sf]

Now, $x_1 + x_2 = 29.9499 + 0.0500836 = 29.9999836 \cong 30$

$x_1 \times x_2 = 29.9499 \times 0.0500836 = 1.5$

$\therefore$ Correct root $= 0.0500836$