Q4 $x^4 + \sin x$ degree 3

a) $x_0 = 4$ $x_1 = x_0 + 0.2$

$$x^4 + \sin x + \frac{(4x^3 + \cos x)(0.2)}{!1} + \frac{(12x^2 - \sin x)(0.2)^2}{!2} + \frac{(24x - \cos x)(0.2)^3}{!3}$$

$$256 + \sin 4 + (256 + \cos 4)(0.2) + \frac{(192 - \sin x)(0.2)^2}{2} + \frac{(96 - \cos 4)(0.2)^3}{6}$$

b) $x_0 = 3$ $x_1 = x_0 - 0.7$

$$x^4 + \sin x + \frac{(4x^3 + \cos x)(-0.7)}{!1} + \frac{(12x^2 - \sin x)(-0.7)^2}{!2} + \frac{(24x - \cos x)(-0.7)^3}{!3}$$

$$81 + \sin 3 + (108 + \cos 3)(-0.7) + \frac{(108 - \sin 3)(-0.7)^2}{2} + \frac{(72 - \cos 3)(-0.7)^3}{6}$$

Q5

a) An unsigned int can store a larger number b/c it doesn't give up a bit to the sign

b) A double uses more memory than a float. 64 bits as opposed to 32 bits.
More memory means doubles are more accurate.

c) B/c integers are defined with known increments of 1, it is possible to use the == operator to compare their values

a = 1
b = 1
return a == b → should return a True

d) Set an appropriate threshold epsilon below which you can declare equality. Then compare the absolute value of their difference to that epsilon. If it is lower, then they can be declared equal and not equal otherwise.

$\left.\begin{array}{l} a = x \\ b = y \end{array}\right\}$ float/doubles

eps = 1E-8

return abs(a-b) < eps → returns true when difference is small enough

e) Machine error for doubles is $2.2204 \cdot 10^{-6}$

Q6

a) 1482/2 = 741 (0) 741/2 = 370 (1) 370/2 = 185 (0) 185/2 = 92 (1) 92/2 = 46 (0)

46/2 = 23 (0) 23/2 = 11 (1) 11/2 = 5 (1) 5/2 = 2 (1) 2/2 = 1 (0) 1/2 = 0 (1)

$\boxed{(10111001010)_2 = (1482)_{10}}$

b) 0.1·2 = 0.2 0.2·2 = 0.4 0.4·2 = 0.8 0.8·2 = 1.6 0.6·2 = 1.2 0.2·2 = 0.4 0.4·2 = 0.8 0.8·2 = 1.6

$\boxed{(0.00011001)_2 = (0.1)_{10}}$

C) Yes, it makes the value larger

base 10   32 → 320 ← ten times larger

$(16)_{10}$   $(32)_{10}$

base 2   10000 → 100000 ← two times larger

D) if a zero is added to the right of a decimal number, nothing changes

$(0.5 = 0.50)_{10}$   $(0.1 = 0.10)_2$

True   True