

## 1.4 Converting From Decimal

$$\frac{7}{4} = 1 + \frac{3}{4}$$

1 is the quotient (Q for short)  
3 " remainder (R for short)

To find Q and R using a calculator:

$$7 \div 4 = 1.75$$

$$Q = 1$$

$$R = 4 \times 0.75 = 3$$

Ex: Find Q and R

a)  $50 \div 4$   
 $= 12.5$

$$Q = 12$$
$$R = 4 \times 0.5 = 2$$

b)  $92 \div 8$   
 $= 11.5$

$$Q = 11$$
$$R = 8 \times 0.5 = 4$$

$$\begin{aligned} c) \quad & 133 \div 16 \\ & = 8.3125 \end{aligned}$$

$\begin{aligned} Q &= 8 \\ R &= 16 \times 0.3125 = 5 \end{aligned}$
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To convert from decimal to another base  
We do repeated division.

Ex: Convert  $106_{10}$  to octal (base 8)

	Q	R
$106 \div 8$	13	2
$13 \div 8$	1	5
$1 \div 8$	0	1

Stop when you reach  $Q=0$   
Answer is R values, in reverse order.

$$106_{10} = 152_8$$

Ex: Convert 58 to binary

	Q	R
$58 \div 2$	29	0
$29 \div 2$	14	1
$14 \div 2$	7	0
$7 \div 2$	3	1
$3 \div 2$	1	1
$1 \div 2$	0	1

$$58_{10} = 111010_2$$

Ex: Convert 1792 to octal

	Q	R
$1792 \div 8$	224	0
$224 \div 8$	28	0
$28 \div 8$	3	4
$3 \div 8$	0	3

$$1792_{10} = 3400_8$$

Ex: Convert 547 to base 5

	Q	R
$547 \div 5$	109	2
$109 \div 5$	21	4
$21 \div 5$	4	1
$4 \div 5$	0	4

$$547_{10} = 4142_5$$

Ex: Convert 53710 to hexadecimal

	Q	R	
$53710 \div 16$	3356	14	E
$3356 \div 16$	209	12	C
$209 \div 16$	13	1	
$13 \div 16$	0	13	D

(A=10 B=11 C=12 D=13 E=14 F=15)

$$53710_{10} = D1CE_{16}$$

To convert non-integer numbers from decimal to another base we do repeated multiplication.

Ex: Convert 0.375 to binary

	Integer	Non-Integer
$0.375 \times 2$	0	0.75
$0.75 \times 2$	1	0.5
$0.5 \times 2$	1	0

Stop when you reach Non-Integer = 0.  
Answer is Integer values, in order.

$$0.375_{10} = 0.011_2$$

Ex: Convert 0.8125 to binary

	I	N
$0.8125 \times 2$	1	0.625
$0.625 \times 2$	1	0.25
$0.25 \times 2$	0	0.5
$0.5 \times 2$	1	0

$$0.8125_{10} = 0.1101_2$$

Ex: Convert 0.734375 to hexadecimal

	I	N
$0.734375 \times 16$	11	0.75
$0.75 \times 16$	12	0

(A=10, B=11, C=12)

$$0.734375_{10} = 0.BC_{16}$$

Ex: Repeating Pattern  
Convert 0.1 to binary

	I	N
$0.1 \times 2$	0	0.2
$0.2 \times 2$	0	0.4
$0.4 \times 2$	0	0.8
$0.8 \times 2$	1	0.6
$0.6 \times 2$	1	0.2
$0.2 \times 2$	0	0.4

Pattern will keep repeating

$$0.1_{10} = 0.0\overline{0011}_2$$

Ex: Convert 0.7 to octal

	I	N
$0.7 \times 8$	5	0.6
$0.6 \times 8$	4	0.8
$0.8 \times 8$	6	0.4
$0.4 \times 8$	3	0.2
$0.2 \times 8$	1	0.6
$0.6 \times 8$		

$$0.7_{10} = 0.5\overline{4631}_8$$

Ex: Convert 19.96875 to octal

	Q	R		I	N
$19 \div 8$	2	3	$0.96875 \times 8$	7	0.75
$2 \div 8$	0	2	$0.75 \times 8$	6	0

$$19.96875_{10} = 23.76_8$$

Ex: Convert  $52.5625$  to base 4

	Q	R
$52 \div 4$	13	0
$13 \div 4$	3	1
$3 \div 4$	0	3

	I	N
$0.5625 \times 4$	2	0.25
$0.25 \times 4$	1	0

$$52.5625_{10} = 310.21_4$$