# Arithmetic in Different Bases

NOT ON SYLLABUS

## Binary (Base 2)

| | |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 10 |
| 3 | 11 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 |
| 8 | 1000 |

## Denary (Decimal

| | | | |
|---|---|---|---|
| 1000 | 100 | 10 | 1 |
| $10^3$ | $10^2$ | $10^1$ | 1 |
| | 4 | 3 | 2 |

four hundred and thirty two

Binary

| | | | |
|---|---|---|---|
| $2^3$ | $2^2$ | $2^1$ | 1 |
| 8 | 4 | 2 | 1 |
| | 1 | 1 | 1 |

$4+2+1=7$

5 + 6 in binary

$$\begin{array}{r} 101 \\ {}_{1}110 \\ \hline 1011 \end{array} \quad +$$

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octal

7 6 5 4 3 2 1 0

| | | |
|---|---|---|
| $8^2$ | $8^1$ | 1 |
| 64 | 8 | 1 |

Hexadecimal

octal can easily replace binary

| | | | | | |
|---|---|---|---|---|---|
| Hex | 2 | E | A | 7 | |
| eg | 1011101010011 | | | | |
| octal | 2 | 7 | 2 | 4 | 7 |

Hexadecimal 16 patterns

0 1 2 3 4 5 6 7 8 9 A B C D E F

Roman

I II III IV V VI VII VIII IX X

C M

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Time

5 hrs 38 min 42 sec

4 hrs 45 min 39 sec +

1 1 1 1

10 hrs 24 min 21 sec

2 hrs 39 min 44 sec

3 hrs 48 min 32 sec

4 hrs 55 min 20 sec

2 2 1

11 hrs 23 min 36 sec

12 inches = 1 foot

3 feet = 1 yard

22 yards = 1 chain

10 chains = 1 furlong

8 furlongs = 1 mile

1760 yards = 1 mile

63,360 inches = 1 mile

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Length

| yds | feet | inches |
|---|---|---|
| 4 | 2 | 11 |
| 3 | 1 | 5 |
| 8 yds | 1 ft | 4 ins |

16 ounces (oz) = 1 pound (lb)

14 pounds = 1 stone

8 stones = 1 hundredweight (cwt)

20 hundredweight = 1 ton

| | | |
|---|---|---|
| 3st | 12 lbs | 11 oz |
| 2st | 7 lbs | 12 oz |
| 6st | 6 lbs | 7 oz |

Money

12 pennies = 1 shilling

20 shillings = 1 pound = £1

| £ | s | d |
|---|---|---|
| 5 | 7 | 11 |
| 3 | 18 | 6 |
| £9 | 6s | 5d |

$\pi = 3.14159$

$\frac{22}{7} = 3.14286$

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Subtraction

3814 − 2927

$$\begin{array}{r} {}^{2}\cancel{3}\,{}^{1}\cancel{8}\,{}^{1}\cancel{0}\,{}^{1}\cancel{1}\,4 \\ 2\,9\,2\,7 \\ \hline 8\,8\,7 \end{array} -$$

$$\begin{array}{r} 4\cancel{5}\text{ hrs } {}^{6+}2\cancel{3}\,{}^{11}\cancel{2}\text{ min } {}^{6+}14\text{ sec} \\ 2\text{ hrs } 44\text{ min } 53\text{ sec} \\ \hline 2\text{ hrs } 47\text{ min } 21\text{ sec} \end{array} -$$

Exercise

$$
\begin{array}{rrrr}
{}^{3}\cancel{4} & \text{hrs} & {}^{6+}17\ \text{min} & {}^{3}\cancel{4}\,{}^{1}3\ \text{sec} \\
1 & \text{hr} & 44\ \text{min} & 37\ \text{sec} \quad - \\
\hline
2 & \text{hrs} & 33\ \text{min} & 06\ \text{sec} \\
\hline
\end{array}
$$