

## Pre-Course Quiz

The following exercises are intended to get you thinking about mathematics again before starting the EMB course. They are all based on the level of maths expected at Key Stage 4 Higher and GCSE. If you encounter any problems, please discuss them with your College supervisor. Different members of this class have very different mathematical backgrounds, so do not worry if you cannot complete all the exercises in the time allocated.

If you are attempting these questions during the class, *please spend no more than 15 minutes on them* and then ask a demonstrator for the next task. You are permitted to use a calculator – although you shouldn't need one for most questions – for questions 6, 7 and parts (ii) to (iv) of question 8.

You should have *TWO* copies of this quiz: write the answers on one copy, and mark any questions you had difficulty with on the other copy and consult your College supervisor about them.

**Name:**

**College:**

**How far have you taken mathematics up to now?**

*(A typical answer might be 'GCSE grade B plus one term of the AS mathematics course'.)*

### (1) Approximations.

- (i) Round off the number 4384556 to 2 significant figures.
- (ii) Round off the number 4384556 to 3 significant figures.
- (iii) Round off the number 0.000033678 to 2 significant figures and write the result in scientific notation.
- (iv) Round off the number 3.14159265 to 3 decimal places.

### (2) Fractions and percentages.

- (i) Evaluate  $\frac{1}{2} + \frac{1}{3}$ .
- (ii) Evaluate  $\frac{1}{2} \times \frac{1}{3}$ .
- (iii) Evaluate  $\frac{1}{2} \div \frac{1}{3}$ .
- (iv) Change  $\frac{3}{20}$  to a decimal.
- (v) Change 7 % to a decimal.

- (vi) Change  $\frac{1}{8}$  to a percentage.
- (vii) What is the percent increase of a rise in temperature from  $80^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ ?  
(Work this out for both the Kelvin and the Celsius temperature scales.)

**(3) Order of operations.**

Simplify the following expressions:

- (i)  $6 + 4 \times 3^2$ .
- (ii)  $3^2 + 6(4 + 1)$ .
- (iii)  $12 - 2(8 + 2) + 5$ .
- (iv)  $8[3(3^2 - 8) + 1]$ .
- (v)  $6\{4[2(3 + 2) - 8] - 8\}$ .
- (vi)  $6(12 + 8) \div 2 + 1$ .

**(4) Algebraic expressions.**

- (i) Simplify the expression  $x + 5 + 3x - 6 + 9x + 3 - 4$ .
- (ii) Simplify the expression  $5y^2 - 4y + 8 - y^2 + 7y + 5$ .
- (iii) Multiply out the expression  $(3x + 5)^2$  and simplify the result.
- (iv) Simplify the expression  $4(xy^3)^5$ .
- (v) Factorise the expression  $8x^3 - 12x^2$
- (vi) Factorise the expression  $2x^2 - 8x + 6$ .
- (vii) Evaluate  $\frac{x}{3} - \frac{x+2y}{y}$  if  $x = 2$  and  $y = 6$ .

**(5) Solving equations.**

- (i) Solve the following equation for  $x$ :  $5x + 7 = 2x + 13$ .
- (ii) Solve the following equation for  $y$ :  $\frac{4}{7}y + 6 = 18$ .
- (iii) Solve the following equation for  $x$ :  $x^2 - 6x + 8 = 0$ .
- (iv) Solve the following inequality for  $x$ :  $4x - 3 < x - 6$ .
- (v) Solve the following equation for  $x$ :  $x^2 - x - 4 = 0$ .
- (vi) Solve the following equation for  $x$ :  $x^3 + 2x^2 - x - 2 = 0$ .
- (vii) Solve the following equation for  $a$ :  $\frac{a-1}{3} + \frac{a+2}{6} = 2$ .

**(6) Series.**

- (i) The  $n$ th term in an arithmetic series of numbers,  $t_n$ , can be expressed using the formula  $t_n = t_1 + (n-1)d$ , where  $t_1$  is the first term and  $d$  is the common

difference between consecutive terms. Use this formula to determine the value of the 12th term in the following sequence: 3, 8, 13, 18, 23, ... .

- (ii) The  $n$ th term in a geometric series of numbers,  $t_n$ , can be expressed using the formula  $t_n = t_1 \times r^{n-1}$ , where  $t_1$  is the first term and  $r$  is the common ratio. If  $t_1 = 1$  and  $r = 3$ , evaluate the first six terms of the series.
- (iii) Work out a formula for the  $n$ th term of the following series: 32, 302, 3002, 30002, ... .

### (7) Coordinates and graphs.

For the points  $A$  and  $B$ , which have the  $(x, y)$  coordinates  $(1, 2)$  and  $(4, 6)$ , respectively:

- (i) Determine the length of the line that connects  $A$  and  $B$ .
- (ii) Determine the slope of the line that connects  $A$  and  $B$ .
- (iii) Determine the equation of the straight line that goes through  $A$  and  $B$ , along with the coordinates of the points where this line intersects with the  $x$  and  $y$  axes.
- (iv) Determine the equation of the line parallel to  $AB$  that goes through the origin.

### (8) Trigonometry and geometry.

- (i) Evaluate  $\sin(30^\circ)$ ,  $\sin(120^\circ)$ ,  $\sin(210^\circ)$ ,  $\sin(300^\circ)$  and  $\cos\left(\frac{5\pi}{4}\right)$ .
- (ii) If a triangle has two angles equal to  $110^\circ$  and  $20^\circ$ , determine the size of the third angle.
- (iii) Let  $ABC$  be a triangle whose angles at  $A$  and  $B$  are  $30^\circ$  and  $45^\circ$ . If the side opposite angle  $B$  has length 9 cm, find the lengths of the remaining sides and the size of the angle at  $C$ .
- (iv) Calculate the surface area and the volume of a cube of side 4 cm.

*If you find that you can solve all 8 questions easily within 15 minutes, you should probably consider changing to the Mathematical Biology course.*

### Need some help?

There are many excellent web sites for revising mathematics at this level, including:

<http://www.bbc.co.uk/schools/gcsebitesize/maths/>