Paper A   IB SL Paper 1 Practice Papers
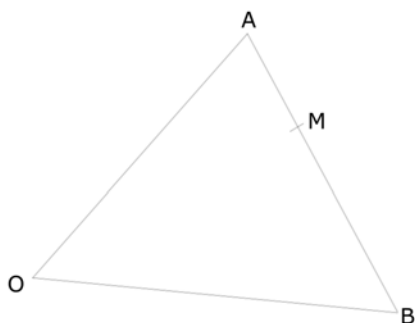
As a guideline this paper should be completed in 1 hour.

No Calculator to be used in this examination.

Section A [42 marks]

1. *[Maximum mark 4]*

    In the diagram below the position vectors of *A* and *B* are represented by the vectors **a** and **b** respectively.

    Given that 2*AM* = *BM*, find the position vector of *M*.

2. *[Maximum mark 6]*

    $$p = \begin{pmatrix} -1 \\ -5 \end{pmatrix} + s \begin{pmatrix} -1 \\ 4 \end{pmatrix} \text{ and } q = \begin{pmatrix} -5 \\ 0 \end{pmatrix} + t \begin{pmatrix} -2 \\ -3 \end{pmatrix}.$$

    Find the position vector at the point where the lines *p* and *q* intersect.

3. *[Maximum mark 7]*

    A die is biased such that the probability of getting a six is $\frac{1}{4}$. The die is rolled 2000 times. Let *X* be the number of sixes obtained. Find,

    a)   the mean of *X*,

    b)   the standard deviation of *X*, leaving your answer as a surd.

4.   *[Maximum mark 6]*

      The function *f(x)* is defined as $f(x) = \dfrac{\cos x}{e^{2x}}$

      Find $f'(x)$.

5.   *[Maximum mark 10]*

      a)   Write the function $f(x) = 3x^2 - 24x + 47$ in the form
            $f(x) = a(x - p)^2 + q$.

      b)   Hence find the vertex of $f(x)$.

      c)   Find the inverse of $f(x)$.

6.   *[Maximum mark 6]*

      The matrix *A* is

      $$A = \begin{bmatrix} 2 & 0 & -1 \\ 4 & 5 & -2 \\ 1 & -1 & x \end{bmatrix}.$$

      Find the value of *x* such that the matrix is singular, e.g. it has no inverse.

7.   *[Maximum mark 3]*

      A particle is moving from a fixed point such that it's displacement from the point is given by the equation $s = 4t - t^2 - e^t$, where *s* is displacement in metres after *t* seconds.

      a)   Find the equation of the velocity of the particle at time *t*.

      b)   Find the equation of the acceleration of the particle at time *t*.

Section B [18 marks]

8. *[Maximum mark 18]*

   The sets A, B, and C are subsets of U. they are defined as:
   $U = \{$the numbers from 1 to 20 inclusive$\}$
   $A = \{$square numbers$\}$
   $B = \{$multiples of 2$\}$
   $C = \{$prime numbers$\}$

   i)   List the elements (if any) of,

          a) A,

          b) B,

          c)   C,

          d) $(A \cup B \cup C)'$.   *[4 marks]*

   ii)   a)   Draw a Venn diagram showing the relationship between the
              sets U, A, B and C.

         b)   Write the elements of sets U , A , B and C in the
              appropriate places on
              the Venn diagram.   *[6 marks]*

   iii) On your diagram shade the area represented by $(A \cup B) \cap C$.
                                                              [2 marks]

   iv)   Find the probability that a number chosen from the universal
         set, U, will be:

         a)   a prime number;

         b)   a square and a prime number;

         c)   a multiple of 2, given that the number is prime;

         d)   prime, given that the number is a multiple of 2.

                                                              [6 marks]

Answers

1. $\dfrac{2}{3}a + \dfrac{1}{3}b$

2. $(-3,3)$

3. a) $E(x) = 500$ b) $\sigma = 5\sqrt{15}$

4. $f'(x) = \dfrac{2\cos x - \sin x}{e^{2x}}$

5. a) $3\left(x - 4\right)^2 - 1$ b) $(4,-1)$

6. $x = 1.3$

7. a) $v = 4 - 2t - e^t$ b) $a = -2 - e^t$

8. i) a) $A=\{1,4,9,16\}$
            $B=\{2,4,6,8,10,12,14,16,18,20\}$
            $C=\{2,3,5,7,11,13,17,19\}$
            $\left(A \cup B \cup C\right)' = \{15\}$

    ii) iii)

    iv) a) $\dfrac{2}{5}$ b) 0   c) $\dfrac{1}{8}$ d) $\dfrac{1}{10}$