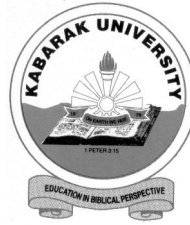**KABARAK**   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE-UNIVERSITY MATHEMATICS

COURSE CODE: PMATH 021

COURSE TITLE: VECTOR AND GEOMETRY

STREAM: PRE - UNIVERSITY

DAY: MONDAY

TIME: 8.30 – 10.30 A.M.

DATE: 08/12/2008

PLEASE TURN OVER

SECTION A (40 MARKS) COMPULSORY

1. (a) Determine the value of λ for which

   $a = i + j + k$ and $b = \lambda^2 i - 2\lambda j + k$ are perpendicular. **(3 mks)**

   (b) Determine the largest interior angle of a triangle whose sides measure 11.9 cm, 8.4 cm and 17.5 cm. **(4 mks)**

   (c) Determine the equation of the perpendicular bisector of the line segment AB, given A(2, 5) and B(6, 1). **(4 mks)**

   (d) Find the centre and radius of the circle whose equation is $x^2 + 3x - 4y = 6 - y^2$

   (4 mks)

2. (a) Given $a = 2i + 2j - k$ and $b = 6i - 3j + 2k$
   Determine the angle between a and b **(4 mks)**

   (b) If $A = 2i - 3j - k$ and $B = i + 4j - 2k$ find the cross product of (A + B) and (A- B)
   (4 mks)

   (c) A scout 20m from the foot of a flag-post notices that that angle of elevation of the top of Post is 40^0. By how many more meters should he move away from the post for the angle of elevation of its top to be 30^0? **(4 mks)**

3. (a) Solve the following pair of equations by substitution method.
   $2x + 3y = 2$
   $x - 2y = 8$ **(3 mks)**

   (b) A particle is acted upon by forces
   $F_1 = 4i + j - 3k$ and $F_2 = 3i + j - k$ thereby displacing it from the point
   $p = i + 2j + 3k$ to $Q = 5i + 4j + k$
   Determine the total work done. **(4 mks)**

(c) A stationery company sells two types of counter books, A and B. The cost of A is Ksh. 120 and the cost of B is Ksh. 100. The company receives a supplies order for 33 counter books with a cheque of Ksh. 3600 from Kabarak University. If the order does not specify the number of each type to be supplied, graphically determine how the company should fill the order. **(6 mks)**

SECTION B (30 MARKS) ANSWER ANY THREE QUESTIONS

QUESTION FOUR (10 MKS)

(a) Define the following terms;

        (i)   Unit vector **(1 mk)**
        (ii)   Vector quantity **(1 mk)**
        (iii)   Scalar quantity **(1 mk)**

(b) If A and B are nonzero vectors in a three-dimension plane,

Show that $A \cdot B = B \cdot A$ **(3 mks)**

(c)   Given $a = i - j + 3k$ and $b = 3i + 4j + 1k$,

Find $|b \, x \, a|$ **(3 mks)**

QUESTION FIVE (10 MARKS)

(a) The area of a sector of a circle of radius 7 cm is 30.8 cm^2. Determine the length of the arc of this sector. **(4 mks)**

(b) (i) Show that $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ **(2 mks)**

     (ii) Solve the trigonometric equation $7\sin^2 x - 5\sin x + \cos^2 x = 0$ **(4 mks)**

QUESTION SIX (10 MARKS)

(a) A circle passes through the points A(2, -2) and B(3, 4). Its centre lies on the line $x = 2 - y$
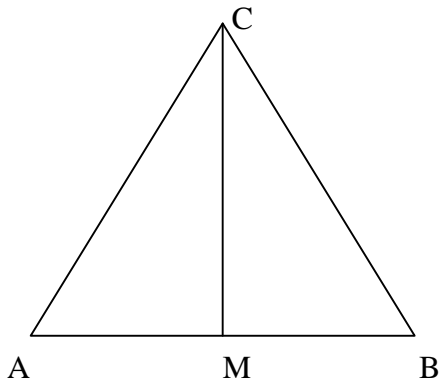
Determine the equation of the circle. **(8 mks)**

(b) By using a suitable, show that $\cos 30^0 = \dfrac{\sqrt{3}}{2}$ **(2 mks)**

QUESTION SEVEN (10 MARKS)

(a) A State and prove the ratio theorem **(4 mks)**

(b) In triangle ABC, 5 AM = 2AB and MQ = QC. Find the position vectors of Q in terms

of a, b and c the position vectors of A, B and C respectively.

(4 mks)

(c) Show that $\cos^2 \theta + \sin^2 \theta = 1$ **(2 mks)**