STAMFORD COLLEGE

SCHOOL OF ENGINEERING

FOUNDATION STUDIES IN ENGINEERING (ELECTRICAL AND ELECTRONIC)

KE013: TRIGONOMETRY

Date : 4 January 2007 (Thursday)
Time : 2.00 pm –4.00 pm **Duration: 2 hours + 10 minutes reading time**

Instructions to Candidates

1. **SIX** questions set.
2. Answer any **FOUR** questions.
3. All questions carry equal marks.
4. Maximum marks attainable: 100

Please ensure that this examination paper contains **SIX** questions on **FOUR** printed pages before you start the examination.

Books, papers and other written materials are not allowed to be brought into the examination hall. A candidate who violates the examination rules of Stamford College or commits a malpractice will be disqualified from the examination.
Write your Examination Index Number on each page of your answer booklet.

ANSWER ANY FOUR QUESTIONS

Question 1

(a) (i) Convert the angle 45° 36'18" into decimal degree format

(2 marks)

(ii) Convert 18.478 into degrees, minutes and seconds

(2 marks)

(iii) Convert 31° to radians.

(1 mark)

(iv) Convert 1.784 radian to degrees

(1 mark)

(b) Find the radius ‘r’ for the Figure 1b.

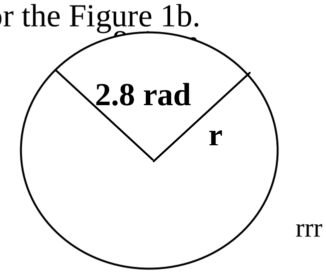


Figure 1b

(4 marks)

(c) Find the length of the arc cut off on a circle of radius 14.2 cm by a centre angle of 120°

(4 marks)

(d) A ladder of length 3 m leans against a wall at an angle 56° to horizontal. Calculate the vertical height.

(4 marks)

(e) State and prove the Pythagoras Theorem.

(7 marks)

(Total = 25 marks)

Question 2

(a) Complete the following identities:

(i) $\sin(A+B)=$

(ii) $\sin(\pi/2-B)=$

(iii) $\cos(A-B)=$

(iv) $\cos(\theta+2\pi)=$

(v) $\tan(A-B)=$

(5 marks)

(b) Prove the following trigonometric identities:

(i) $1+\tan^2\theta = \sec^2\theta$

(ii) $\sin 2\theta = 2\sin\theta\cos\theta$

(iii) $\dfrac{\cos x}{1+\sin x} = \sec x - \tan x$

(iv) $\dfrac{1+\sec x}{\sin x + \tan x} = \cos ec x$

(20 marks)

(Total = 25 marks)

Question 3

(a) Prove the following trigonometric identity:

$$\frac{\sin(A-B)}{\cos A\cos B} + \frac{\sin(B-C)}{\cos B\cos C} + \frac{\sin(C-A)}{\cos A\cos C} = 0$$

(10 marks)

(b) Prove the following:

(i) $\cos ec^4\theta - \cot^4\theta = \dfrac{1+\cos^2\theta}{1-\cos^2\theta}$

(ii) $\dfrac{\tan\theta - \cot\theta}{\sin\theta\cos\theta} = \sec^2\theta - \cos ec^2\theta$

(iii) $\tan\theta + \cot\theta = 2\cos ec 2\theta$

(15 marks)

(Total = 25 marks)

Question 4

(a) The distance between the centre points of two identical circles with radius of 5 cm each are 6 cm as shown in [illegible] Find the area of the segment overlapped by the two circles.

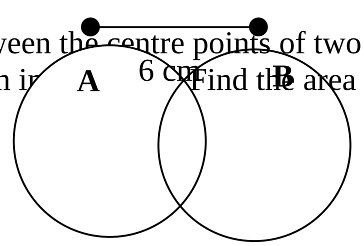
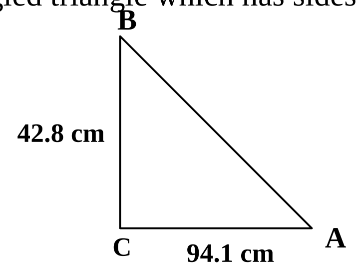


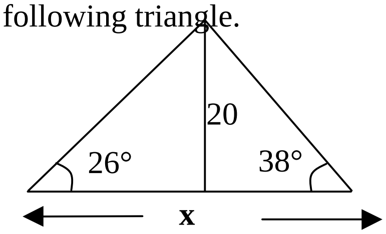
Figure 5a (12 marks)

(b) Solve the right angled triangle which has sides a = 42.8 cm and b= 94.1cm



(6 marks)

(c) Solve the following triangle.

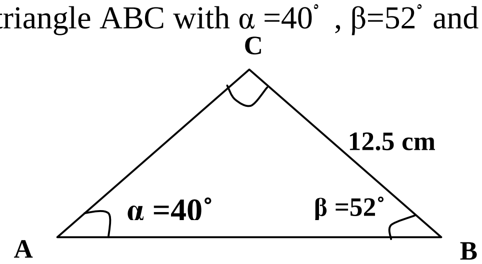


(7 marks)

(Total = 25 marks)

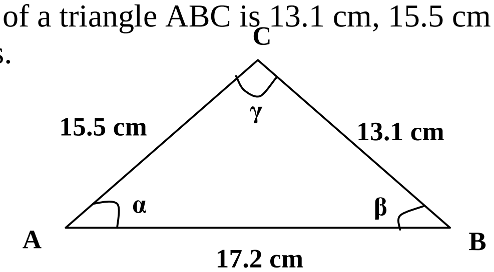
Question 5

(a) Solve the triangle ABC with α =40˚ , β=52˚ and a=12.5 cm using sine rule.



(6 marks)

(b) The side length of a triangle ABC is 13.1 cm, 15.5 cm and 17.2 cm. Find the angle α, β and γ in degrees.



(13 marks)

(c) Sketch a 2-cycle graph of the function defined by $y = 3\cos(4t - \frac{\pi}{4})$

(6 marks)

(Total = 25 marks)

Question 6

(a) A regular hexagon is inscribed in a circle of radius 5 cm. Find the perimeter and the area of the hexagon.

(10 marks)

(b) The mutually tangent circles have radii 4,5 and 6 cm respectively as shown in Figure 6b. Calculate:

(i) the angles of the triangle with the vertices as their centres.

(ii) the area of dashed region between the circle.

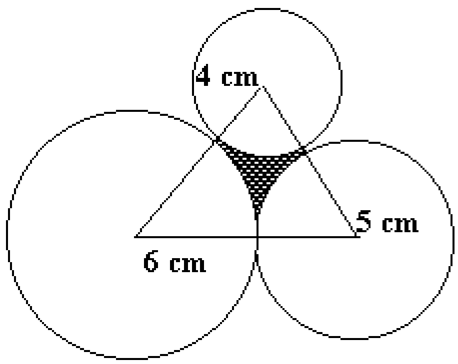


Figure 6b

(15 marks)

(Total = 25 marks)

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