MATHEMATICS

MATERIAL FOR GRADE 12

H I G H F L Y E R S

SESSION 5

TRIGONOMETRY

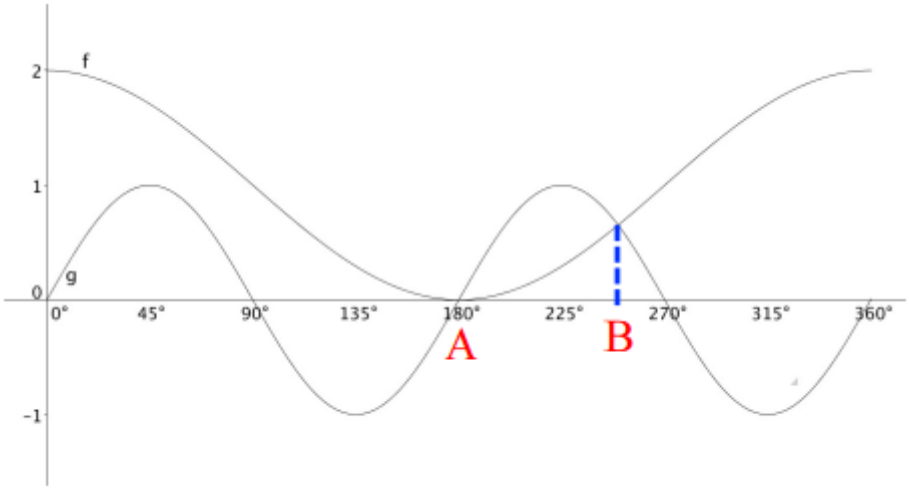
Q U E S T I O N S

90 minutes

QUESTION 1

1.1 Draw the graph of h(x) = sin2x – cos2x for -90° ≤ x ≤ 180°. (4)

1.2 The diagram below shows the graphs of f(x) = cos x + 1 and g(x) = sin 2x, for 0° ≤ x ≤ 360°. Use it to find the approximate general solution to 2sin x cos x = cos x + 1. (3)



QUESTION 2: Solving trig equations

2.1 Find the general solution of $sin^2\beta + \sin 2\beta = 1$, where $\cos \beta \neq 0$ (4)

QUESTION 3: Miscellaneous manipulations and calculations

3.1 Evaluate:

3.1.1 $cos^2 15° - sin^2 15°$ (3)
3.1.2 $\sin 105°$ (5)

3.2 If sin 21° = a, express the following in terms of a.

i. cos 42° (3)
ii. sin 81° (3)

3.3 If sin 22° cos 12° = a and sin 12° cos 22° = b, express sin 34° in terms of a and b. (2)

QUESTION 4: Simplifying expressions / algebraic manipulations

4.1 Simplify the following to a single trig ratio:

$$\sin\left(\frac{\beta}{2} + 45°\right).cos\left(\frac{\beta}{2} + 45°\right)$$ (3)

4.2 Simplify the following without using a calculator:

$$\frac{COS(45°-\theta)}{COS\ 45°.COS\ \theta} - \tan\theta \qquad (5)$$

QUESTION 5: Proving identities

5.1 Prove that: $\sin 2x + 2sin^2(45° - x) = sin^2 x + cos^2 x$ (4)

5.2 Hence show that: $sin^2 15° = \frac{2-\sqrt{3}}{4}$ (3)

5.3 Given: $\sin\theta \cdot \cos\beta = -1$

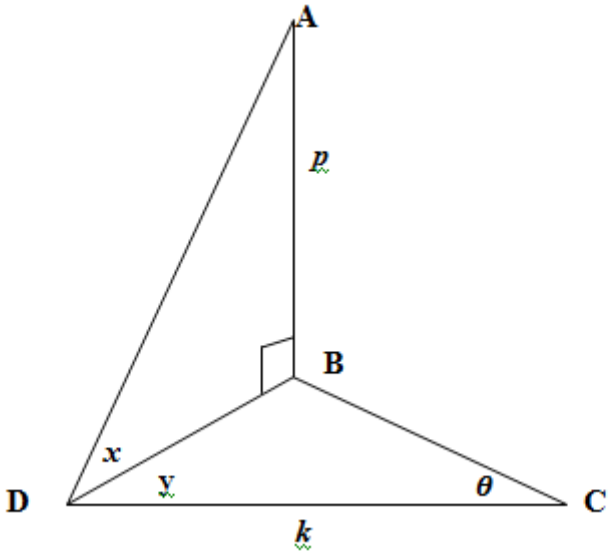
5.3.1 Write down the maximum and minimum value of $\cos\beta$. (2)

5.3.2 Solve for $\theta \in [0°; 270°]$ and $\beta \in [-180°; 90°]$. (6)

[15]

QUESTION 6

AB is a vertical tower of *p* units high.
D and C are in the same horizontal plane as B, the foot of the tower.
The angle of elevation of A from D is *x*. $B\widehat{D}C = y$ and $D\hat{C}B = \theta$.
The distance between D and C is *k* units.



6.1.1 Express *p* in terms of DB and *x*. (3)

6.1.2 Hence prove that: $p = \dfrac{ksin\theta tanx}{sinycos\theta + cosysin\theta}$ (5)

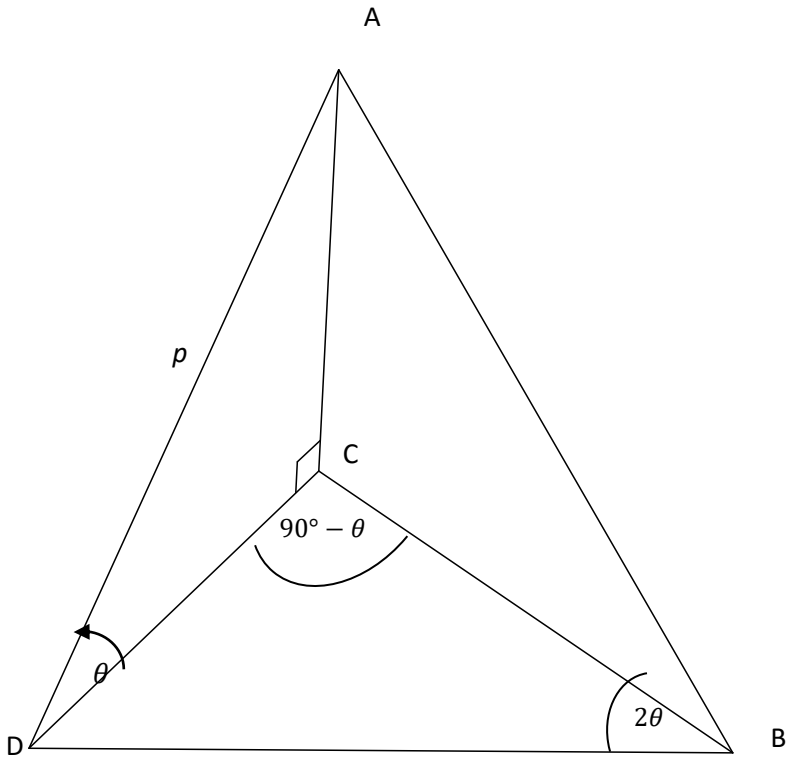
6.2 Find BC to the nearest meter if $x = 51{,}7°$, $y = 62{,}5°$, $p = 80\ m$ and $k = 95\ m$. (4)

[12]

QUESTION 7

In the diagram below, D, B and C are points in the same horizontal plane. AC is a vertical pole and the length of the cable from D to the top of the pole, A, is p meters. AC ⊥ CD. $A\hat{D}C = \theta$;

$D\hat{C}B = (90° - \theta)$ and $C\hat{B}D = 2\theta$.



7.1 Prove that: (5)

$$BD = \frac{p\cos\theta}{2\sin\theta}$$

7.2 Calculate the height of the flagpole AC if $\theta = 30°$ and $p = 3$ meters. (3)

7.3 Calculate the length of the cable AB if it is further given that $A\hat{D}B = 70°$ (5)

[13]