Topic: All SL Trig topic

Total Marks: 79 Total Time: 1 hour 30 minutes

Prior to starting the test, please take a moment to carefully review the following instructions:

1. On the first page please mention your name, start time, and end time of the test and share your answer sheet as a single pdf.
2. To create a realistic test environment, ensure that you are live on Zoom during the test, for that you must use the Zoom app not web version. Keep your video camera turned on and share your entire desktop.
3. **IMPORTANT:** If you encounter any questions that haven't been covered in class yet or fall outside the test syllabus, no need to worry. Just skip that question and mention 'NA', and your grades will be based on the questions you attempted.
4. Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
5. You are allowed to use the official IB formula booklet for all tests

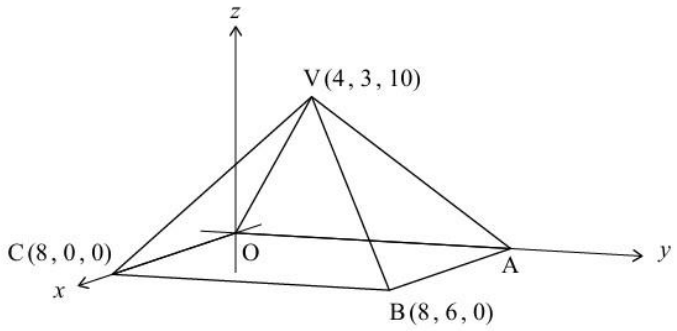
Question 1: Calculator Allowed: Yes

2. [Maximum mark: 6]

The following diagram shows a pyramid with vertex V and rectangular base OABC.

Point B has coordinates $(8, 6, 0)$, point C has coordinates $(8, 0, 0)$ and point V has coordinates $(4, 3, 10)$.

diagram not to scale



(a) Find BV. [2]

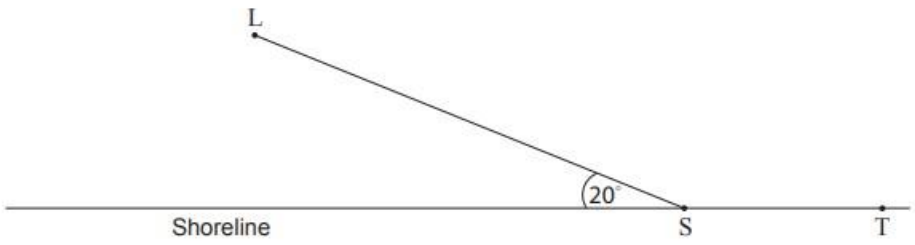
(b) Find the size of $\mathrm{B\hat{V}C}$. [4]

Question 2:

Calculator Allowed: Yes

[Maximum mark: 13]

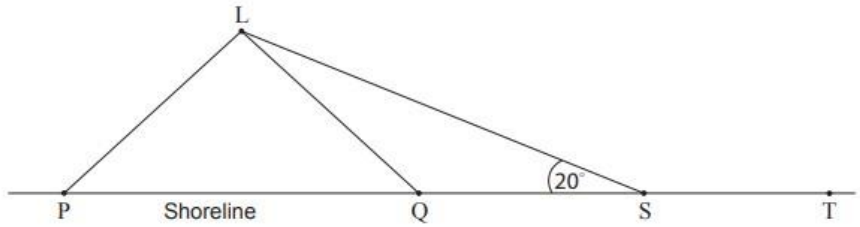
The following diagram shows a straight shoreline, with a supply store at S, a town at T, and an island L.



A boat delivers supplies to the island. The boat leaves S, and sails to the island. Its path makes an angle of 20° with the shoreline.

(a) The boat sails at $6\,\text{km}$ per hour, and arrives at L after 1.5 hours. Find the distance from S to L. [2]

It is decided to change the position of the supply store, so that its distance from L is $5\,\text{km}$. The following diagram shows the two possible locations P and Q for the supply store.



(b) Find the size of $\text{S}\hat{\text{P}}\text{L}$ and of $\text{S}\hat{\text{Q}}\text{L}$. [5]

(c) The town wants the new supply store to be as near as possible to the town.

(i) State which of the points P or Q is chosen for the new supply store.

(ii) Hence find the distance between the old supply store and the new one. [6]

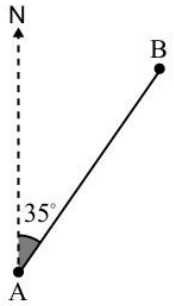
Question 3:

Calculator Allowed: Yes

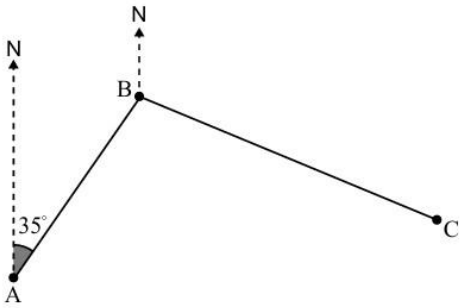
7. [Maximum mark: 16]

Adam sets out for a hike from his camp at point A. He hikes at an average speed of $4.2\,\text{km/h}$ for 45 minutes, on a bearing of 035° from the camp, until he stops for a break at point B.

(a) Find the distance from point A to point B. [2]



Adam leaves point B on a bearing of 114° and continues to hike for a distance of $4.6\,\text{km}$ until he reaches point C.



(b) (i) Show that $A\hat{B}C$ is 101°.

(ii) Find the distance from the camp to point C. [5]

(c) Find $B\hat{C}A$. [3]

Adam's friend Jacob wants to hike directly from the camp to meet Adam at point C.

(d) Find the bearing that Jacob must take to point C. [3]

Jacob hikes at an average speed of $3.9\,\text{km/h}$.

(e) Find, to the nearest minute, the time it takes for Jacob to reach point C. [3]

Question 4:

Calculator Allowed: Yes

[Maximum mark: 5]

ABCD is a quadrilateral where $AB = 6.5$, $BC = 9.1$, $CD = 10.4$, $DA = 7.8$ and $C\hat{D}A = 90°$.
Find $A\hat{B}C$, giving your answer correct to the nearest degree.

Question 5: Calculator Allowed: No

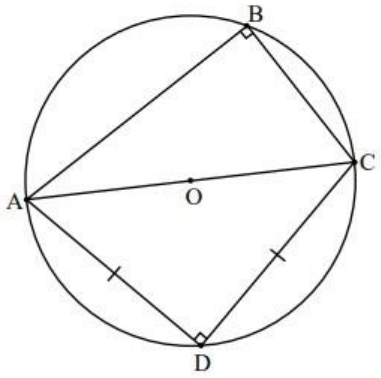
[Maximum mark: 5]

Find the least positive value of x for which $\cos\left(\frac{x}{2}+\frac{\pi}{3}\right)=\frac{1}{\sqrt{2}}$.

Question 6: Calculator Allowed: No

(a) Given that $\cos 75° = q$, show that $\cos 105° = -q$. [1]

In the following diagram, the points A, B, C and D are on the circumference of a circle with centre O and radius r. [AC] is a diameter of the circle. $BC = r$, $AD = CD$ and $A\hat{B}C = A\hat{D}C = 90°$.



(b) Show that $B\hat{A}D = 75°$. [3]

(c) (i) By considering triangle ABD, show that $BD^2 = 5r^2 - 2r^2q\sqrt{6}$.

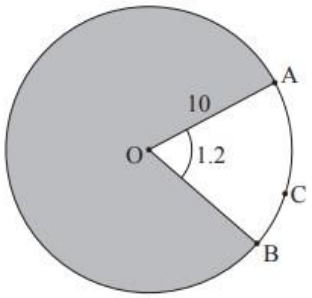
(ii) By considering triangle CBD, find another expression for BD^2 in terms of r and q. [7]

(d) Use your answers to part (c) to show that $\cos 75° = \frac{1}{\sqrt{6}+\sqrt{2}}$. [3]

Question 7:
Calculator Allowed: No

[Maximum mark: 5]

The following diagram shows a circle with centre O and a radius of 10 cm. Points A, B and C lie on the circle.



Angle AOB is 1.2 radians.

(a) Find the length of arc ACB. [2]

(b) Find the perimeter of the shaded region. [3]

Question 8: Calculator Allowed: No

[Maximum mark: 5]

Let $\sin\theta = \frac{\sqrt{5}}{3}$, where θ is acute.

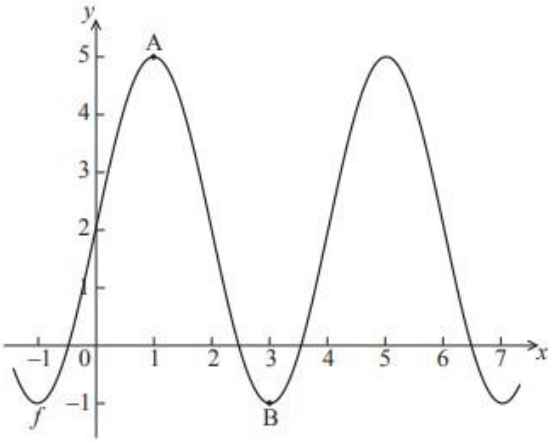
(a) Find $\cos\theta$. [3]

(b) Find $\cos 2\theta$. [2]

Question 9:
Calculator Allowed: No

5. *[Maximum mark: 6]*

The diagram below shows part of the graph of a function f.



The graph has a maximum at $A(1, 5)$ and a minimum at $B(3, -1)$.

The function f can be written in the form $f(x) = p\sin(qx) + r$. Find the value of

(a) p; *[2 marks]*

(b) q; *[2 marks]*

(c) r. *[2 marks]*

Question 10:

Calculator Allowed: No

[Maximum mark: 4]

It is given that $\text{cosec}\theta = \frac{3}{2}$, where $\frac{\pi}{2} < \theta < \frac{3\pi}{2}$. Find the exact value of $\cot\ \theta$.