MEGA LECTURE

IB DP MATHEMATICS

AA Topic 3 · Geometry and Trigonometry

TOPICAL WORKSHEET

3.1 Right-Angled Trigonometry · 3.2 Sine & Cosine Rules
3.3 Radian Measure & Circular Functions · 3.4 Trig Graphs & Equations

Standard and Higher Level · Syllabus 2025

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Original exam-style questions written for the IB Diploma Programme Mathematics course (first assessment 2025)

Section A — Multiple Choice (15 marks)

Circle the letter of the best answer to each question. Each question is worth 1 mark.

1. For a right-angled triangle with angle θ, the ratio opposite$\div$adjacent is equal to **[1]**

A $\sin\theta$

B $\cos\theta$

C $\tan\theta$

D $1\div\tan\theta$

2. A right-angled triangle has legs of length 6 and 8. The length of the hypotenuse is **[1]**

A 10

B 12

C 14

D 48

3. In a right-angled triangle, the side opposite angle θ has length 3, and the hypotenuse has length 5. The value of $\sin\theta$ is **[1]**

A 0.4

B 0.5

C 0.6

D 0.8

4. In any right-angled triangle, the two non-right angles **[1]**

A are always equal to each other

B sum to 90°

C sum to 180°

D cannot be determined without more information

5. For a triangle with sides a, b, c and opposite angles A, B, C, the cosine rule states **[1]**

A $a^2 = b^2+c^2 - 2bc\cos A$

B $a\div\sin A = b\div\sin B$

C $a^2 = b^2+c^2$

D $a^2 = b^2-c^2$

6. For a triangle with sides a, b, c and opposite angles A, B, C, the sine rule states **[1]**

A $a^2 = b^2+c^2-2bc\cos A$

B $a\div\sin A = b\div\sin B = c\div\sin C$

C $a\times\sin A = b\times\sin B$

D $\sin A\div a = b\times c$

7. The area of a triangle with sides a and b and included angle C is given by **[1]**

A Area = ab

B Area = ½ab

C Area = ½absinC

D Area = abcosC

8. To find an unknown side of a triangle given two angles and one side (AAS), the most appropriate rule to use is **[1]**

A the cosine rule

B the sine rule

C Pythagoras' theorem

D the discriminant

9. One full revolution (360°) is equivalent to **[1]**

A π radians

B 2π radians

C π÷2 radians

D 360 radians

10. For a circle of radius r, the arc length s subtended by an angle θ (in radians) is given by **[1]**

A $s = r\theta$

B $s = \frac{1}{2}r^2\theta$

C $s = 2\pi r\theta$

D $s = r \div \theta$

11. For a circle of radius r, the area A of a sector subtended by an angle θ (in radians) is given by **[1]**

A $A = r\theta$

B $A = \pi r^2$

C $A = \frac{1}{2}r^2\theta$

D $A = 2r\theta$

12. An angle of 90° is equivalent to **[1]**

A π÷6 radians

B π÷4 radians

C π÷3 radians

D π÷2 radians

13. For the function $y = 3\sin(2x) + 1$, the amplitude is **[1]**

A 1

B 2

C 3

D 6

14. For the function y = 3sin(2x) + 1, the period is **[1]**

A π÷2

B π

C 2π

D 4π

15. For the function y = 3sin(2x) + 1, the equation of the principal axis (midline) is **[1]**

A y = 0

B y = 1

C y = 2

D y = 3

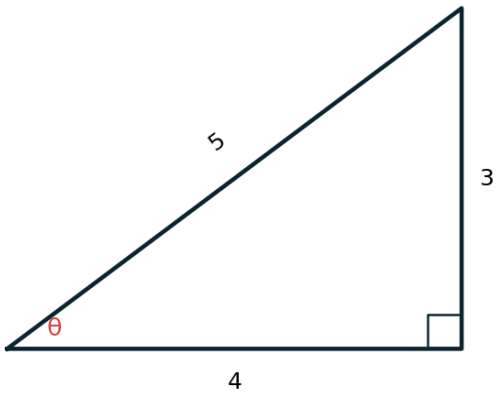
Section B — Structured Questions (65 marks)

Answer all questions in the space provided. Working must be shown for full marks.

3.1 Right-Angled Trigonometry

Question 1 [7 marks]

The diagram shows a right-angled triangle with base 4, height 3, and hypotenuse 5 (computed, a 3-4-5 triangle).



A right-angled triangle with sides 3, 4, and 5 (computed).

(a) Using the diagram, identify the hypotenuse of the triangle, and state which side is opposite angle θ. **[2]**

(b) Using $\tan\theta = \text{opposite} \div \text{adjacent}$, calculate θ, giving your answer to 1 decimal place. **[2]**

(c) Verify your answer to part (b) using $\sin\theta = \text{opposite} \div \text{hypotenuse}$ instead. **[3]**

Question 2 [6 marks]

Pythagoras' theorem and the basic trigonometric ratios apply to any right-angled triangle.

(a) State Pythagoras' theorem for a right-angled triangle with legs a and b and hypotenuse c. **[2]**

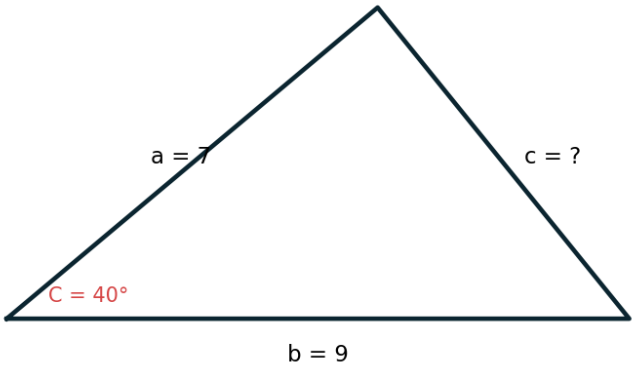
(b) A right-angled triangle has legs of length 6 and 8. Calculate the length of the hypotenuse. **[2]**

(c) For this triangle, calculate the angle opposite the side of length 8. **[2]**

3.2 Sine & Cosine Rules

Question 3 [7 marks]

The diagram shows a triangle with sides a = 7, b = 9, and included angle C = 40° (computed, SAS case).



Triangle with a = 7, b = 9, C = 40° (computed).

(a) Using the diagram, state which rule (sine or cosine) is appropriate for finding side c, and explain why. **[2]**

(b) State the cosine rule used to find side c in terms of a, b, and C. **[2]**

(c) Calculate the length of side c, giving your answer to 3 significant figures. **[3]**

Question 4 [6 marks]

A triangle has a = 10, A = 30°, and B = 70°.

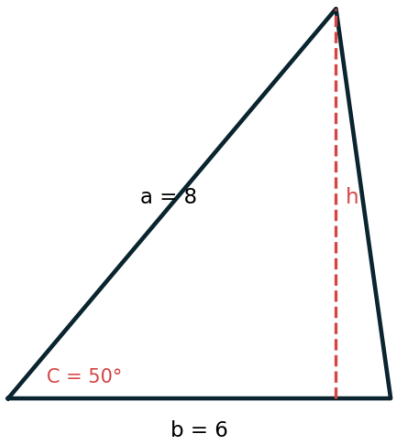
(a) State the sine rule relating sides a and b to angles A and B. **[2]**

(b) Using the sine rule, calculate the length of side b, giving your answer to 3 significant figures. **[2]**

(c) Calculate the size of angle C. **[2]**

Question 5 [7 marks]

The diagram shows a triangle with sides a = 8, b = 6, and included angle C = 50° (computed), with the perpendicular height h from the vertex opposite b shown.



Triangle with a = 8, b = 6, C = 50°, showing the height h (computed).

(a) Using the diagram, state the formula for the area of this triangle in terms of a, b, and C. **[2]**

(b) Calculate the area of the triangle, giving your answer to 3 significant figures. **[2]**

(c) Calculate the height h shown on the diagram, and hence verify your answer to part (b) using Area = ½ × base × height. **[3]**

3.3 Radian Measure & Circular Functions

Question 6 [6 marks]

Angles can be measured in degrees or in radians; the arc length formula uses radian measure.

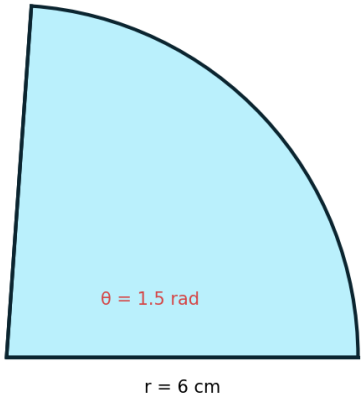
(a) Convert 60° to radians, giving your answer as an exact multiple of π. **[2]**

(b) State the formula for the arc length s subtended by an angle θ (in radians) in a circle of radius r. **[2]**

(c) Calculate the arc length in a circle of radius 5 cm, subtended by an angle of 1.2 radians. **[2]**

Question 7 [7 marks]

The diagram shows a sector of a circle with radius r = 6 cm and angle θ = 1.5 radians (computed).



A circular sector, r = 6 cm, θ = 1.5 rad (computed).

(a) Using $s = r\theta$, calculate the arc length of this sector. **[2]**

(b) State the formula for the area of a sector, in terms of r and θ. **[2]**

(c) Calculate the area of the sector shown in the diagram. **[3]**

Question 8 [6 marks]

Radians and degrees are related by 180° = π radians.

(a) State the relationship between degrees and radians for a full circle (360°). **[2]**

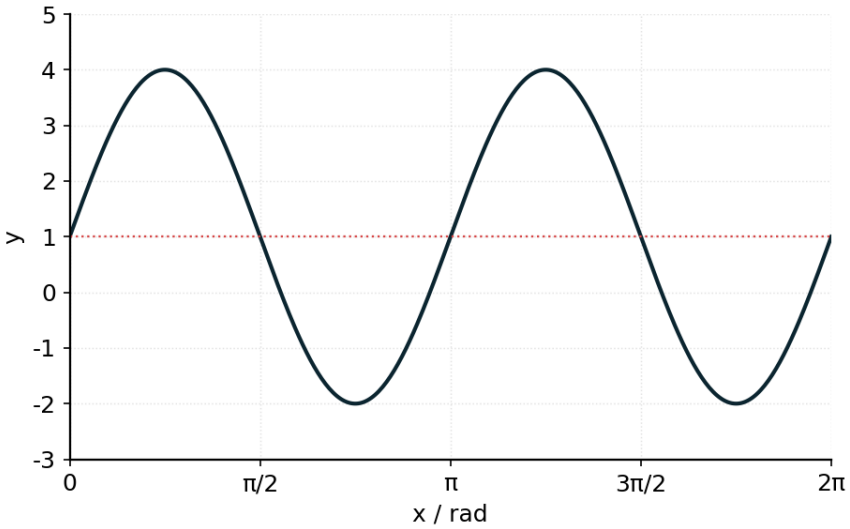
(b) Convert $5\pi \div 6$ radians to degrees. **[2]**

(c) A sector has area 40 cm^2 and radius 8 cm. Find the angle θ, in radians, that this sector subtends. **[2]**

3.4 Trig Graphs & Equations

Question 9 [7 marks]

The graph shows the function y = 3sin(2x) + 1, for 0 ≤ x ≤ 2π (computed).



y = 3sin(2x) + 1 for 0 ≤ x ≤ 2π (computed).

(a) Using the graph, state the amplitude and the period of this function. **[2]**

(b) State the maximum and minimum values of y, and the equation of the principal axis. **[2]**

(c) Solve the equation 3sin(2x) + 1 = 1 for 0 ≤ x ≤ 2π. **[3]**

Question 10 [6 marks]

The Pythagorean identity relates sinθ and cosθ for any angle θ.

(a) State the Pythagorean identity relating sinθ and cosθ. **[2]**

(b) Given that $\sin\theta = 0.6$, and θ is acute, calculate the exact value of $\cos\theta$. **[2]**

(c) Solve the equation $2\sin\theta = 1$ for $0° \leq \theta \leq 360°$. **[2]**