∑ DANEMATHICS
FREE CAPS MATHS RESOURCES

GRADE 10 · TRIGONOMETRY

Trig Ratios for Any Angle: CAST & Reference Angles (Grade 10)

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
33	50 minutes	3

Name: ..... Class: .....

Date: .....

MARK ____ / 33

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 $305°$ lies in ... (1)

A) the first quadrant
B) the second quadrant
C) the fourth quadrant ✓
D) the third quadrant

Answer: C — $270° < 305° < 360°$.

- **A** — the first quadrant runs only from $0°$ to $90°$
- **B** — the second quadrant runs from $90°$ to $180°$
- **D** — the third quadrant stops at $270°$

1.2 The reference angle for $210°$ is ... (1)

A) $60°$
B) $30°$ ✓
C) $150°$
D) $210°$

Answer: B — In the third quadrant, $\beta = 210° - 180° = 30°$.

- **A** — that is $270° - 210°$, measured from the wrong axis
- **C** — that is $360° - 210°$
- **D** — a reference angle is always acute

1.3 $\cos 120° = \ldots$ (1)

A) $-\frac{1}{2}$ ✓ **B)** $\frac{1}{2}$

C) $-\frac{\sqrt{3}}{2}$ **D)** $\frac{\sqrt{3}}{2}$

> **Answer: A** — Second quadrant, $\beta = 60°$, cosine negative: $-\cos 60° = -\frac{1}{2}$.
>
> - **B** — forgot that cosine is negative in the second quadrant
> - **C** — used $\sin 60°$ instead of $\cos 60°$
> - **D** — the wrong ratio and the wrong sign

1.4 $\sin\theta < 0$ and $\cos\theta > 0$ in ... (1)

A) the first quadrant **B)** the second quadrant

C) the third quadrant **D)** **the fourth quadrant** ✓

> **Answer: D** — CAST: only cosine is positive in the fourth quadrant.
>
> - **A** — both are positive there
> - **B** — there sine is positive and cosine negative
> - **C** — there both are negative

1.5 $P(-3\ ;\ 4)$ lies on the terminal arm of θ. Then $\cos\theta = \ldots$ (1)

A) $\frac{4}{5}$ **B)** $-\frac{4}{3}$

C) $-\frac{3}{5}$ ✓ **D)** $\frac{3}{5}$

> **Answer: C** — $r = \sqrt{9+16} = 5$, and $\cos\theta = \frac{x}{r} = -\frac{3}{5}$.
>
> - **A** — that is $\sin\theta = \frac{y}{r}$
> - **B** — that is $\tan\theta = \frac{y}{x}$
> - **D** — dropped the sign of x

1.6 $\tan 225° = \ldots$ (1)

A) -1 **B)** 1 ✓

C) $\sqrt{3}$ **D)** 0

> **Answer: B** — Third quadrant, $\beta = 45°$, tangent positive: $\tan 45° = 1$.
>
> - **A** — tangent is POSITIVE in the third quadrant
> - **C** — that is $\tan 60°$, not $\tan 45°$
> - **D** — that is $\tan 180°$

1.7 If $\sin\theta = \frac{12}{13}$ and θ is obtuse, then $\cos\theta = \ldots$ (1)

A) $-\frac{5}{13}$ ✓ **B)** $\frac{5}{13}$

C) $-\frac{12}{5}$ **D)** $\frac{5}{12}$

Answer: A — Obtuse puts θ in the second quadrant: $y = 12$, $r = 13$, so $x = -5$ and $\cos\theta = -\frac{5}{13}$.

- **B** — an obtuse angle is in the second quadrant, where cosine is negative
- **C** — that is tan θ
- **D** — that is the reciprocal of tan θ, with the wrong sign

1.8 cosec $30° = \ldots$ (1)

A) $\frac{1}{2}$ **B)** $\frac{2}{\sqrt{3}}$

C) $\sqrt{3}$ **D)** 2 ✓

Answer: D — $\text{cosec}\,30° = \frac{1}{\sin 30°} = \frac{1}{\frac{1}{2}} = 2$.

- **A** — that is sin $30°$ itself
- **B** — that is sec $30° = 1 \div \cos 30°$
- **C** — that is cot $30°$

1.9 sec θ is undefined when $\theta = \ldots$ (1)

A) $0°$ **B)** $180°$

C) $90°$ ✓ **D)** $45°$

Answer: C — $\sec\theta = \frac{1}{\cos\theta}$, and $\cos 90° = 0$: division by zero is undefined.

- **A** — $\cos 0° = 1$, so $\sec 0° = 1$
- **B** — $\cos 180° = -1$, so $\sec 180° = -1$
- **D** — $\cos 45° = \frac{\sqrt{2}}{2}$, so $\sec 45° = \sqrt{2}$

1.10 $\sin 330° + \cos 240° = \ldots$ (1)

A) 0 **B)** -1 ✓

C) 1 **D)** $-\sqrt{3}$

Answer: B — $\sin 330° = -\sin 30° = -\frac{1}{2}$ and $\cos 240° = -\cos 60° = -\frac{1}{2}$; the sum is -1.

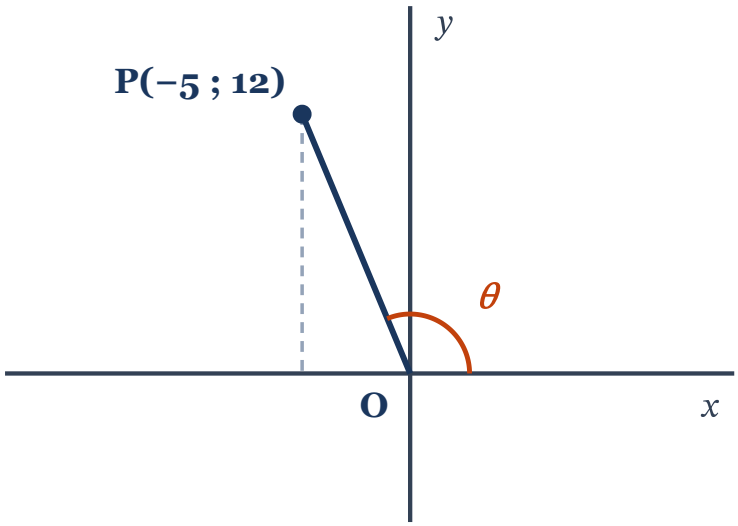
- **A** — both terms are negative, so they cannot cancel
- **C** — sine is negative in the fourth quadrant and cosine negative in the third
- **D** — used the ratios of $60°$ and $30°$ the wrong way round

ANSWER GRID — MARKING GUIDELINE

1.1	A	B	**C**	D
1.2	A	**B**	C	D
1.3	**A**	B	C	D
1.4	A	B	C	**D**
1.5	A	B	**C**	D
1.6	A	**B**	C	D
1.7	**A**	B	C	D
1.8	A	B	C	**D**
1.9	A	B	**C**	D
1.10	A	**B**	C	D

QUESTION 2 [10 MARKS]

P$(-5\ ;\ 12)$ lies on the terminal arm of θ, as shown in the diagram below.



2.1 Calculate the length of OP. **(2)**

$OP^2 = (-5)^2 + 12^2 = 169$ *(1)*
$OP = \mathbf{13}$ *(1)*

2.2 Write down the values of sin θ, cos θ and tan θ. **(3)**

$\sin\theta = \frac{12}{13}$ *(1)*

$\cos\theta = -\frac{5}{13}$ *(1)*

$\tan\theta = -\frac{12}{5}$ *(1)*

2.3 Determine the value of $\text{cosec}\ \theta + \cot\ \theta$. **(3)**

$\text{cosec}\ \theta = \frac{13}{12}$ *(1)*

$\cot\ \theta = -\frac{5}{12}$ *(1)*

$\text{cosec}\ \theta + \cot\ \theta = \frac{8}{12} = \mathbf{\frac{2}{3}}$ *(1)*

2.4 Explain, without using a calculator, why $90° < \theta < 180°$. **(2)**

x is negative and y is positive *(1)*
so P lies in the second quadrant, which runs from $90°$ to $180°$ *(1)*

QUESTION 3 [13 MARKS]

Answer the following WITHOUT using a calculator.

3.1 Evaluate $\frac{\sin 210° \times \cos 330°}{\tan 135°}$. **(5)**

$\sin 210° = -\sin 30° = -\frac{1}{2}$ *(1)*

$\cos 330° = \cos 30° = \frac{\sqrt{3}}{2}$ *(1)*

$\tan 135° = -\tan 45° = -1$ *(1)*

$\frac{(-\frac{1}{2})(\frac{\sqrt{3}}{2})}{-1} = \mathbf{\frac{\sqrt{3}}{4}}$ *(2)*

3.2 If $13\cos\theta + 5 = 0$ and $180° < \theta < 360°$, determine the value of $\sin\theta + \tan\theta$. **(5)**

$\cos\theta = -\frac{5}{13}$ *(1)*
cosine is negative, so θ is in the third quadrant *(1)*
$x = -5$, $r = 13$, so $y = -12$ *(1)*
$\sin\theta = -\frac{12}{13}$ and $\tan\theta = \frac{12}{5}$ *(1)*
$\sin\theta + \tan\theta = -\frac{60}{65} + \frac{156}{65} = \mathbf{\frac{96}{65}}$ *(1)*

3.3 Explain why $\text{cosec}\ 180°$ is undefined. **(3)**

$\text{cosec}\ \theta = \frac{1}{\sin\theta}$ *(1)*
$\sin 180° = 0$ *(1)*
and division by zero is undefined *(1)*

TOTAL: 33 marks

This question paper consists of 3 questions.

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