



Test Papers
Hub.

HSC Mathematics Extension 1 Practice Paper 1

Practice Examination

**Reading time 10 minutes · Working time 2 hours · Section I: 10 multiple-choice ·
Section II: 60 marks · 70 marks in all**

How to use this booklet

- Reading time – 10 minutes. Working time – 2 hours. Write using black pen. Calculators approved by NESA may be used.
- A reference sheet is assumed to be provided, as in the real examination. For questions in Section II, show relevant mathematical reasoning and/or calculations.
- Worked solutions follow the paper: every question has step-by-step working and a key takeaway.

SECTION I

10 marks · Attempt Questions 1 – 10

Allow about 15 minutes for this section. Choose the best answer for each question.

1. How many solutions does $\sin x + \sqrt{3} \cos x = 2$ have for $0 \leq x \leq 2\pi$?

- A 2
- B 1
- C 3
- D 0

2. If $f(x) = \arcsin(3x)$, find $f'(\frac{1}{6})$.

- A $-1 + 2\sqrt{3}$
- B $4\sqrt{3}$
- C $2\sqrt{3}$
- D $6\sqrt{\frac{35}{35}}$

3. The radius of a spherical balloon increases at 4 cm/s. The rate at which its volume increases when the radius is 6 cm is

- A $576\pi \text{ cm}^3/\text{s}$
- B $144\pi \text{ cm}^3/\text{s}$
- C $288\pi \text{ cm}^3/\text{s}$
- D $96\pi \text{ cm}^3/\text{s}$

4. The gradient of the curve $y = \sin(5x + 3)$ at $x = 2$ is

- A $-5\cos(13)$
- B $\cos(13)$
- C $10\cos(13)$
- D $5\cos(13)$

5. The gradient of the curve $2x^2 + 3y^2 + xy = 6$ at the point (1, 1) is

- A -0.6666666666666667
- B $\frac{5}{7}$
- C $\frac{7}{5}$
- D $-\frac{5}{7}$

6. The graph of $y = x^3 - \frac{21x^2}{2} + 36x$ has a local maximum at $x = a$ and a local minimum at $x = b$. The value of $b - a$ is

- A 1
- B 7
- C 2
- D 12

7. A particle moves in simple harmonic motion with displacement $x = 3 \cos(6t)$ metres. Find its maximum acceleration.

- A 18 m/s^2
- B 108 m/s^2
- C 39 m/s^2
- D 648 m/s^2

8. The angle between $a = -i - k$ and $b = -i + 3j + 3k$, in degrees correct to one decimal place, is

- A 71.1
- B 108.9
- C 118.9
- D -18.9

9. In how many ways can 5 people stand in a line if two particular people must stand next to each other?

- A 48
- B 50
- C 120
- D 24

10. $\frac{dy}{dx} = 0.5y$ and $y = 7$ when $x = 0$. The value of y when $x = 1$, correct to two decimal places, is

- A 51.72
- B 7.5
- C 11.54
- D 1.65

WORKED SOLUTIONS

Answers & worked solutions

Multiple-choice answer key

1	B	2	C	3	A	4	D	5	D	6	A
7	B	8	B	9	A	10	C				

SECTION I

1. How many solutions does $\sin x + \sqrt{3} \cos x = 2$ have for $0 \leq x \leq 2\pi$? [Auxiliary angle]

Correct answer: B — 1

- $\sin x + \sqrt{3} \cos x = 2 \sin(x + \frac{\pi}{3})$, which has amplitude 2.
- $2 \sin(x + \frac{\pi}{3}) = 2$ has 1 solution in $[0, 2\pi]$.
- Why the other options are wrong:
- A (2): Write $\sin x + \sqrt{3} \cos x = 2 \sin(x + \frac{\pi}{3})$, amplitude 2: count where it equals 2 (a value equal to the amplitude is touched once, a larger value is never reached).
- C (3): Write $\sin x + \sqrt{3} \cos x = 2 \sin(x + \frac{\pi}{3})$, amplitude 2: count where it equals 2 (a value equal to the amplitude is touched once, a larger value is never reached).
- D (0): Write $\sin x + \sqrt{3} \cos x = 2 \sin(x + \frac{\pi}{3})$, amplitude 2: count where it equals 2 (a value equal to the amplitude is touched once, a larger value is never reached).

LOS: Ext 1: trigonometry

KEY TAKEAWAY

Combine $a \sin x + b \cos x$ into $R \sin(x + \alpha)$ and count solutions from the amplitude R .

2. If $f(x) = \arcsin(3x)$, find $f'(\frac{1}{6})$. [Derivatives of inverse trig]

Correct answer: C — $2\sqrt{3}$

- $\frac{d}{dx} \arcsin(u) = \frac{u'}{\sqrt{1-u^2}}$.
- $f'(x) = \frac{3}{\sqrt{1-3^2x^2}}$; at $x = \frac{1}{6}$: $\frac{3}{\sqrt{1-\frac{1}{4}}} = 2\sqrt{3}$.
- Why the other options are wrong:
- A ($-1 + 2\sqrt{3}$): This is the correct answer ($2\sqrt{3}$) minus 3: 3 was taken off at the end of the calculation (an off-by-3 error).
- B ($4\sqrt{3}$): This is the correct answer ($2\sqrt{3}$) doubled: a scaling factor was applied (or a factor missed) that the working above does not use.
- D ($6\sqrt{\frac{35}{35}}$): Chain rule: $\frac{d}{dx} \arcsin(ax) = \frac{a}{\sqrt{1-a^2x^2}}$.

LOS: Ext 1: inverse trig

KEY TAKEAWAY

$\frac{d}{dx} \arcsin(ax) = \frac{a}{\sqrt{1-a^2x^2}}$.