AM — Forms 4 and 5

Name: _____ Date: _____ Score: ____ / 62

Practice A — Concept Check. ENGLISH SELECTED-TOPIC PRACTICE. These 12 multiple-choice questions are supplementary diagnostics: official Additional Mathematics papers contain written questions, with no MCQ section. The official 3472/1 paper is 80 marks in 2 hours: Section A has 12 compulsory questions for 64 marks; Section B requires two of three for 16 marks. Paper 3472/2 is 100 marks in 150 minutes: A has seven compulsory questions for 50 marks; B requires three of four for 30 marks; C requires two of four for 20 marks. This module is not a full official mock. Answer all 12 diagnostics and all three written tasks. Practice marks: 12 MCQ at 1 mark each plus 50 written marks, total 62. Show working, respect stated domains and give exact answers unless an approximation is requested. Topic selection does not predict a future examination paper.

1. Let $f(x) = 2x - 1$ and $g(x) = x^2 + 3$. What is $g(f(2))$?

A 5 **B** 7

C 12 **D** 36

2. The function $f(x) = (x - 2)^2$ has domain $x \geq 2$. Which expression gives $f^{-1}(x)$, for $x \geq 0$?

A $2 + \sqrt{x}$ **B** $2 - \sqrt{x}$

C $\sqrt{(x + 2)}$ **D** $x^2 + 2$

3. For which condition on k does $x^2 - 6x + k = 0$ have two distinct real roots?

A $k > 9$ **B** $k \geq 9$

C $k = 9$ **D** $k < 9$

4. Evaluate $\log_3 27 - \log_3 3$.

A 1 **B** 2

C 3 **D** 4

5. The fifth and ninth terms of an arithmetic progression are 17 and 29 respectively. What is its first term?

A 5 **B** 3

C 8 **D** 14

6. Positive variables satisfy $y = 5x^3$. A straight-line graph has vertical coordinate $\log_{10} y$ and horizontal coordinate $\log_{10} x$. Which pair gives its gradient m and vertical intercept c?

A $m = 5, c = 3$ **B** $m = \log_{10} 5, c = 3$

C $m = 3, c = \log_{10} 5$ **D** $m = 3, c = 5$

7. Vectors $a = (2, -1)$ and $b = (-3, 4)$ are written as ordered pairs. Find $2a + b$.

A $(-1, 2)$ **B** $(1, 2)$

C $(1, -6)$ **D** $(7, -6)$

8. An arc of a circle with radius 12 cm subtends an angle of $\pi/6$ radians at the centre. What is the arc length?

A $\pi/6$ cm **B** π cm

C 6π cm **D** 2π cm

9. Differentiate $y = (3x - 1)^4$ with respect to x.

A $4(3x - 1)^3$

B $12(3x - 1)^4$

C $12(3x - 1)^3$

D $3(3x - 1)^3$

10. Find $\int(6x^2 - 4x + 3)\,dx$, where C is an arbitrary constant.

A $6x^3 - 4x^2 + 3x + C$

B $2x^3 - 4x^2 + 3x + C$

C $2x^3 - 2x^2 + 3 + C$

D $2x^3 - 2x^2 + 3x + C$

11. Two members are selected from six pupils for a committee. There are no distinct roles, and selection order does not matter. How many committees are possible?

A 15

B 30

C 12

D 36

12. Four independent trials each have success probability 0.25. What is the probability of exactly one success?

A 0.10546875

B 0.421875

C 0.31640625

D 0.25

Practice B — Written Tasks. Answer all tasks. Show working; use extra sheets for longer answers.

1. Task 1 · Functions, inverse branches and domains (16 marks). Let $f(x) = (x - 3)^2 + 2$ for $x \geq 3$, and $g(x) = 2x - 1$ for all real x.

(a) State the range of f and explain why the stated domain makes f one-to-one. [4]

(b) Find $f^{-1}(x)$ and state its domain. Show why the positive square-root branch is required. [4]

(c) Find g(f(x)). Solve $g(f(x)) = 35$ within the domain of f. [4]

(d) Let $h(x) = f^{-1}(g(x))$. Find h(x) and its domain. [4]

No graph is supplied or needed. [16 marks]

2. Task 2 · Linear law using exact data (16 marks). A model $y = Ax^n$ is proposed for positive dimensionless variables, where $A > 0$. The following are exact data, not noisy measurements.

x: 1, 2, 4, 8

y: 3, 12, 48, 192

Use $U = \log_{10} x$ and $V = \log_{10} y$. For tabulation, $\log_{10} 2 = 0.30103$ and $\log_{10} 3 = 0.47712$ may be used.

(a) Express V as a linear function of U. [2]

(b) Tabulate all four (U, V) pairs to five decimal places. [4]

(c) Determine the gradient and vertical intercept using the transformed data, then find n and A. Use exact log identities when recovering A. [4]

(d) Find y when $x = 6$ and find positive x when $y = 75$. [4]

(e) Explain why these data alone do not prove that the same model holds beyond the observed range. [2]

A graph is not required; show the gradient calculation and identify the axes in words. [16 marks]

Practice B — Written Tasks. Answer all tasks. Show working; use extra sheets for longer answers.

3. Task 3 · Calculus and changes of direction (18 marks). A particle moves along a straight line. Its velocity is $v(t) = t^2 - 6t + 8$ m s^{-1} for $0 \le t \le 5$ s. Its position at $t = 0$ is $s(0) = 3$ m relative to a fixed origin. Positive velocity means motion in the positive direction.

(a) Find acceleration $a(t)$ and its value at $t = 1$ s. [3]

(b) Find the times when the particle is at rest and state its direction on each interval between these times. [4]

(c) Find the position function $s(t)$. [3]

(d) Find the displacement from $t = 0$ to $t = 5$, and the final position. [3]

(e) Find the total distance travelled during the five seconds. Show each interval contribution and explain why distance differs from displacement. [5] [18 marks]

AM — Worked Answers

Worked solutions · author-created practice rubric

Practice A — Concept Check

Additional Mathematics	1 **C**	2 **A**	3 **D**	4 **B**	5 **A**	6 **C**
	7 **B**	8 **D**	9 **C**	10 **D**	11 **A**	12 **B**

Practice B — Written Tasks

Additional Mathematics

1. (a) The range is [2, ∞), or $y \geq 2$. The square is non-negative and its minimum occurs at $x = 3$, giving $f(3) = 2$. On $x \geq 3$, increasing x strictly increases $(x - 3)^2$, so distinct domain values have distinct images. The unrestricted quadratic would not be one-to-one. Marks: range 1; minimum value/location 1; increasing behaviour on this domain 1; distinct images/one-to-one conclusion 1.

(b) Put $y = (x - 3)^2 + 2$. Then $x - 3 = \pm\sqrt{(y - 2)}$. Since $x \geq 3$, $x - 3 \geq 0$, so $x = 3 + \sqrt{(y - 2)}$. Thus $f^{-1}(x) = 3 + \sqrt{(x - 2)}$, with domain $x \geq 2$. Marks: rearrangement 1; branch justified 1; inverse 1; domain 1.

(c) $g(f(x)) = 2[(x - 3)^2 + 2] - 1 = 2(x - 3)^2 + 3$. Setting this equal to 35 gives $(x - 3)^2 = 16$, so $x = 7$ or -1. Reject -1 because $x \geq 3$; the answer is $x = 7$. Check: $f(7) = 18$ and $g(18) = 35$. Marks: composite 1; square equation 1; both algebraic candidates 1; valid root with domain justification 1.

(d) $h(x) = 3 + \sqrt{[(2x - 1) - 2]} = 3 + \sqrt{(2x - 3)}$. The input to f^{-1} must lie in its domain: $2x - 1 \geq 2$, hence $x \geq 3/2$. Marks: correct substitution 1; simplified expression 1; domain inequality 1; solved domain 1.

Accept equivalent exact interval notation. A rejected root is not discarded arbitrarily; it violates the stated input domain.

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