

A-Level Mathematics
Haydon School

Entrance Examination

Practice Questions and Answers

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Introduction

Students wishing to take A-Level Mathematics at Haydon School must achieve at least a grade 6 (preferably a grade 7 or above) at GCSE and score a minimum of 50% on the entrance examination. Students wishing to study Further Mathematics should achieve a grade 8 at GCSE and achieve at least 70% on the entrance examination.

The A-Level Entrance Examination will take place on Foundation Day.

The examination is a non-calculator paper.

Content of Entrance Examination

The focus of the entrance examination is on the harder algebraic topics covered at GCSE – all the questions are Grade 6 and above GCSE questions on the following topics:

- Indices and Surds
- Solving Equations
 - Linear
 - Quadratic (factorising and use of formula)
 - Simultaneous

- Factorising

- Changing the Subject of Formulae

- Coordinate Geometry of Straight Lines

- Compound and Inverse Functions

If you are unsure as to whether you would be suitable for A-Level Mathematics, then consider how comfortable you are with more complex algebraic topics. At Haydon, much of this content was taught in the Spring Term of Year 11.

We strongly recommend that students study hard in preparation for the entrance examination and do not just rely on their GCSE revision. The following questions will aid revision and should be used in conjunction with other revision materials used to prepare for the GCSE.

Frequently Asked Questions

1. Why do you have an entrance examination? Other schools go just on GCSE grade.

Students are able to get a grade 6 or above at GCSE without having strong algebraic skills. In our experience, such students will not be successful at A-level mathematics, due to the high algebraic content of the A-Level course. The entrance examination tests students' algebraic skills to ensure suitability for the course.

2. What happens if a student only misses a grade 6 by 1 mark?

Unfortunately, students will not be accepted onto the course unless they have met the full entrance criteria. We do not make any exceptions to these criteria.

3. What happens if a student's future career/ university path requires them to have A-Level Mathematics?

We strongly recommend that students have a back-up plan for their A-Level subject choices in case they do not achieve the grades they expect. In our experience, it has been very traumatic for students and parents on results day who do not have an alternative plan in place.

If you have any further questions, please do not hesitate to contact Mrs A Sebrell – Head of A-Level Mathematics at asebrell.312@lgflmail.org

Questions

Section A – Solving Equations

1. Solve $7p + 2 = 5p + 8$
2. Solve $7r + 2 = 5(r - 4)$
3. (a) Solve $20y - 16 = 18y - 9$

(b) Solve $\frac{40-x}{3} = 4 + x$

4. Solve $\frac{x-3}{5} = x - 5$

5. Solve $\frac{x}{3} - 5 = 3(x - 2)$

6. Solve $7(x + 2) = \frac{5x + 1}{2}$

7. Solve $5(x + 8) = \frac{7x - 4}{2}$

8. Solve $\frac{2}{x+1} + \frac{3}{x-1} = \frac{5}{x^2 - 1}$

9. Solve the equation

$$\frac{3}{x+3} - \frac{4}{x-3} = \frac{5x}{x^2 - 9}$$

10. Solve the equation

$$\frac{x}{2x-3} + \frac{4}{x+1} = 1$$

11. (a) Solve $\frac{1}{x} + \frac{1}{2x} = 2$

- (b) Using your answer to part (a), or otherwise,

solve $\frac{3}{(y-1)^2} + 2\frac{3}{(y-1)^2} = 2$

12. (i) Factorise $x^2 - 7x + 12$

- (ii) Solve the equation

$$x^2 - 7x + 12 = 0$$

13. $3x^2 = 108$

Find the value of x

14. Solve $x^2 + 6x = 4$

Give your answers in the form $p \pm \sqrt{q}$, where p and q are integers.

15. Solve $x^2 + 3x - 5 = 0$
Leave your answer in surd form.
16. Solve this quadratic equation.
 $x^2 - 5x - 8 = 0$
Leave your answer in surd form.

Section B – Changing the Subject of the Formula

17. Make a the subject of the formula $s = \frac{a}{4} + 8u$
18. Make a the subject of the formula $2(3a - c) = 5c + 1$
19. Make u the subject of the formula $D = ut + kt^2$
20. Make x the subject of $5(x - 3) = y(4 - 3x)$
21. Make t the subject of the formula $v = u + 5t$
22. $P = \frac{n^2 + a}{n + a}$

Rearrange the formula to make a the subject.

23. $\frac{x}{x + c} = \frac{p}{q}$

Make x the subject of the formula.

Section C – Indices

24. (a) Evaluate
- (i) 3^{-2}
- (ii) $36^{\frac{1}{2}}$
- (iii) $27^{\frac{2}{3}}$
- (iv) $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$
25. (a) Find the value of
- (i) 64^0
- (ii) $64^{\frac{1}{2}}$
- (iii) $64^{-\frac{2}{3}}$
- (b) $3 \times \sqrt{27} = 3^n$
Find the value of n .
26. Find the value of
- (i) 36^2 (ii) 3^{-2}

27. Work out the value of

(i) $(2^2)^3$

(ii) $(\sqrt{3})^2$

(iii) $\sqrt{2^4 \times 9}$

28. (a) Simplify 2^0

(b) Simplify 5^{-1}

29. (a) Write down the value of

(i) 9^0

(ii) $36^{\frac{1}{2}}$

(b) Work out $64^{\frac{2}{3}}$

Section D – Simplifying Expressions

30. Simplify fully

(a) $2(3x + 4) - 3(4x - 5)$

(b) $(2xy^3)^5$

(c) $\frac{n^2 - 1}{n + 1} \times \frac{2}{n - 2}$

31. (a) Factorise $9x^2 - 6x + 1$

(b) Simplify $\frac{6x^2 + 7x - 3}{9x^2 - 6x + 1}$

32. Simplify $\frac{4x^2 - 9}{2x^2 - 5x + 3}$

33. Simplify fully

(a) $(3xy^2)^4$

(b) $\frac{x^2 - 3x}{x^2 - 8x + 15}$

34. Simplify fully $\frac{4x^2 - 6x}{4x^2 - 9}$

35. Simplify fully $\frac{25 - x^2}{25 + 5x}$

36. Simplify $\frac{x^2(5 + x)}{x^2 - 25}$

37. (a) Simplify fully $(3x^2y^4)^3$
 (b) Expand and simplify $(2x + 5)(3x - 2)$
 (c) Simplify fully $\frac{x^2 + 5x + 6}{x^2 + 2x}$

38. Simplify $\frac{x^2 + 5x + 6}{x + 2}$

39. Write as a single fraction $\frac{4}{x(x + 3)} + \frac{5}{(x + 3)}$

40. Write as a single fraction in its simplest form

$$\frac{4}{x + 5} + \frac{1}{x - 3}$$

41. Write $\frac{x}{x - 2} - \frac{3}{x(x - 2)}$ as a single fraction in its simplest form.

42. Simplify fully $\frac{4a - 20}{a^2 - 25}$

Section E – Simultaneous Equations

43. Solve

$$\begin{aligned} 2x - 3y &= 11 \\ 5x + 2y &= 18 \end{aligned}$$

44. Solve

$$\begin{aligned} x + 2y &= 4 \\ 3x - 4y &= 7 \end{aligned}$$

45. Solve the simultaneous equations.

$$\begin{aligned} 5a + 3b &= 9 \\ 2a - 3b &= 12 \end{aligned}$$

46. Solve the simultaneous equations

$$\begin{aligned} 3x - 4y &= 11 \\ 5x + 6y &= 12 \end{aligned}$$

47. Solve the simultaneous equations

$$\begin{aligned} 4x + 2y &= 8 \\ 2x - 5y &= 10 \end{aligned}$$

48. Solve the simultaneous equations

$$\begin{aligned} 3x + 7y &= 26 \\ 4x + 5y &= 13 \end{aligned}$$

49. Solve the simultaneous equations

$$6x - 2y = 33$$

$$4x + 3y = 9$$

50. Solve the simultaneous equations

$$3x + y = 1$$

$$x - 2y = 19$$

51. Solve the simultaneous equations

$$3x - 4y = 13$$

$$2x + 3y = 3$$

52. Solve the simultaneous equations

$$2x + 3y = -3$$

$$3x - 2y = 28$$

53. Solve the simultaneous equations

$$x^2 + y^2 = 29$$

$$y - x = 3$$

54. By eliminating y , find the solutions to the simultaneous equations

$$x^2 + y^2 =$$

$$25 \quad y = x - 7$$

55. Solve the simultaneous equations

$$x + y = 4$$

$$x^2 + y^2 = 40$$

56. By eliminating x , find the solutions to the simultaneous equations

$$x - 2y = 1$$

$$x^2 + y^2 = 13$$

57. By eliminating y , find the solutions to the simultaneous equations

$$y - 2x = 3$$

$$x^2 + y^2 = 18$$

Section F – Coordinate Geometry

58. A straight line, **L**, passes through the point with coordinates (4, 7) and is perpendicular to the line with equation $y = 2x + 3$.

Find an equation of the straight line **L**.

59. The straight line **L**₁ has equation $y = 2x + 3$

The straight line **L**₂ is parallel to the straight line

L₁. The straight line **L**₂ passes through the point (3,

2). Find an equation of the straight line **L**₂.

60. A straight line has equation $y = 2x - 3$
 The point P lies on the straight line.
 The y coordinate of P is -4
- (a) Find the x coordinate of P .
- A straight line L is parallel to $y = 2x - 3$ and passes through the point $(3, 4)$.
- (b) Find the equation of line L .
61. Work out the coordinates of the midpoint of the line joining the points $(4, 5)$ and $(-6, 3)$.
62. The point A has coordinates $(-12, 5)$.
 The point B has coordinates $(12, 3)$.
 M is the midpoint of the line segment AB .
 Find the coordinates of M .
63. Find the equation of the straight line which passes through the point $(0, 3)$ and is perpendicular to the straight line with equation $y = 2x$.

Section G - Compound and Inverse Functions:

64. Given that $f(x) = x - 4$ find:
 a) $f(5)$
 b) $f(3)$
65. Given that $g(x) = 2x^2 - 10$ find:
 a) $g(2)$
 b) $g(-2)$
 c) Solve: $g(x) = 8$
66. Given that $f(x) = 3x - 5$ find:
 a) $f(3)$
 b) $f(-2)$
 c) Solve: $f(x) = 1$
67. Given that $f(x) = x^2 - 3$ find:
 a) $f(10)$
 b) $f(-1)$
 c) Find: $f^{-1}(x)$
68. Given that $f(x) = 2x - 4$ and $g(x) = 3x + 5$
 a) Find: $gf(3)$
 b) Work out an expression for: $f^{-1}(x)$
 c) Solve: $f(x) = g(x)$
69. Given that $f(x) = 3x + 1$ and $g(x) = x^2$
 a) Write down an expression for: $fg(x)$
 b) Work out an expression for: $gf(x)$
 c) Solve: $fg(x) = gf(x)$
70. Given that $f(x) = x^2 - 17$ and $g(x) = x + 3$
 a) Work out an expression for: $g^{-1}(x)$
 b) Work out an expression for: $f^{-1}(x)$
 c) Solve: $f^{-1}(x) = g^{-1}(x)$

71. A function f is defined such that

$$f(x) = x^2 - 1$$

- a) Find an expression for $f(x-2)$
- b) Hence solve: $f(x-2) = 0$

72. A function f is defined such that $f(x) = 4x - 1$

- a) Find: $f^{-1}(x)$

The function g is such that

$$g(x) = kx^2 \text{ where } k \text{ is a constant}$$

Given that $fg(2) = 12$

- b) Work out the value of k

Answers

Section A – Solving Equations

1. $p = 3$
2. $r = -11$
3. (a) $y = 3\frac{1}{2}$
(b) $x = 7$
4. $x = 5\frac{1}{2}$
5. $x = 8^3$
6. $x = -3$
7. $x = -28$
8. $x = 0.8$
9. $x = -3.5$
10. $x = 1, x = 9$
11. (a) $x = \frac{9}{4}$
(b) $y = \frac{5}{2}, -\frac{1}{2}$
12. (i) $(x-3)(x-4)$
(ii) $x = 3, x = 4$
13. $x = 6$
14. $x = -3 \pm \sqrt{13}$
15. $x = \frac{-3 \pm \sqrt{13}}{2}$
16. $x = \frac{-3 \pm \sqrt{13}}{2}$

Section B – Changing the Subject of the Formula

17. $4(s - 8u) = a$
18. $a = \frac{7c + 1}{6}$
19. $u = \frac{D - kt^2}{T}$
20. $x = \frac{4y + 15}{5 + 3y}$
21. $t = \frac{v - u}{5}$

$$22. a = n \frac{n^2 - nP}{P - 1}$$

$$23. x = \frac{pc}{q - p}$$

Section C - Indices

$$24. (a) (i) \frac{1}{9}$$

$$(ii) 6$$

$$(iii) 9$$

$$(iv) \frac{27}{8}$$

$$25. (a) (i) 1$$

$$(ii) 8$$

$$(iii) \frac{1}{16}$$

$$(b) n = \frac{5}{2}$$

$$26. (i) 6$$

$$(ii) \frac{1}{9}$$

$$27. (i) 64$$

$$(ii) 3$$

$$(iii) 12$$

$$28. (a) 1$$

$$(b) \frac{1}{5}$$

$$29. (a) (i) 1$$

$$(ii) 6$$

$$(b) 16$$

Section D - Simplifying Expressions

$$30. (a) -6x + 23$$

$$(b) 32x^5y^{15}$$

$$(c) \frac{2(n-1)}{n-2}$$

$$31. (a)(3x - 1)^2$$

(b) $\frac{2x + 3}{3x - 1}$

32. $\frac{2^{+3}}{-1}$

33. (a) $81x^4y^8$

(b) $\frac{x}{x - 5}$

34. $\frac{2x}{2x + 3}$

35. $\frac{5 - x}{5}$

36. $\frac{x^2}{x - 5}$

37. (a) $27x^6y^{12}$

(b) $6x^2 + 11x - 10$

(c) $\frac{x + 3}{x}$

38. $x + 3$

39. $\frac{5x + 4}{x(x + 3)}$

40. $\frac{5x - 7}{(x + 5)(x - 3)}$

41. $\frac{x^2 - 3}{x(x - 2)}$

42. $\frac{4}{a + 5}$

Section E – Simultaneous Equations

43. $x = 4, y = -1$

44. $x = 3y$
 $= 0.5$

45. $a = 3$
 $b = -2$

46. $x = 3$
 $y = -0.5$

47. $x = 2.5$
 $y = -1$

48. $x = -3$
 $y = 5$

49. $x = 4\frac{1}{2}$
 $y = -3$

50. $x = 3$
 $y = -8$
51. $x = 3, y = -1$
52. $x = 6, y = -5$
53. $x = 2$ and $y = 5$
or
 $x = -5$ and $y = -2$
54. $x = 3, y = -4$
 $x = 4, y = -3$
55. $x = -2$ or 6
 $y = 6$ or -2
56. $y = -2, x = -3$
 $y = 1.2, x = 3.4$
57. $x = -3, y = -3$
 $x = \frac{5}{2}, y = 4\frac{1}{5}$

Section F - Coordinate Geometry

58. $y = -\frac{1}{2}x + 9$
59. $y = 2x - 4$
60. (a) $x = -\frac{1}{2}$

(b) $y = 2x - 2$
61. $(-1, 4)$
62. $(0, 4)$
63. $y = -0.5x + 3$

Section G - Compound and Inverse Functions:

64. a) 1 b) -1
65. a) -2 b) -2 c) $x = \pm 3$
66. a) 4 b) -11 c) $x = 2$
67. a) 97 b) -2 c) $f^{-1}(x) = \sqrt{x+3}$
68. a) 11 b) $f^{-1}(x) = \frac{1}{2}(x+4)$ c) -9
69. a) $3x^2 + 1$ b) $(3x^2 + 1)^2$ c) $x=0, x=-1$
70. a) $g^{-1}(x) = x - 3$ b) $f^{-1}(x) = \sqrt{x+17}$ c) $x=8, x=-1$
71. a) $x^2 - 4x + 3$ b) $x=3, x=1$
72. a) $f^{-1}(x) = \frac{x+1}{4}$ b) $k = \frac{13}{16}$