Rugby Free Secondary School
Maths Department

Mathematics Transition Work
Preparation for A Level Maths

We are pleased that you would like to study Mathematics beyond GCSE and look forward to welcoming you into the sixth form in September. We are of the belief that two and a half months without doing any Mathematics has the potential to lead to you forgetting important ideas, with this in mind here are a few resources to keep your Maths skills going and to prepare you for some of the early topics that we cover in the Autumn Term.

Included in this pack are;

- Revision of Key Algebra Skills & Support Guidance
- Solutions to Key Algebra Skills
- GCSE Questions for A Level – these should be handed in to Mr Telfer when you return in September by the end of the first week back.

Revision of Key Algebra Skills

In September you will sit a baseline assessment to identify any significant gaps in your algebra skills, here is a sneak preview of the type of questions that you will see in the baseline assessment.

1 Simplify these expressions.

a $\dfrac{x^6 \times x^2}{x^5}$ **(1 mark)**

b $(3x^4)^2$ **(1 mark)**

c $\dfrac{4x^{\frac{1}{3}}}{(16x^{-3})^{\frac{3}{4}}}$ **(3 marks)**

2 Solve $2x^3 \times 3x^2 = 6144$ **(2 marks)**

3 Find the value of x.

$x^{-\frac{2}{3}} = \dfrac{1}{25}$ **(2 marks)**

4 **a** Write $\sqrt{448}$ in the form $a\sqrt{7}$, where a is an integer. **(1 mark)**

b Expand and simplify $(3 - \sqrt{5})(2 + 3\sqrt{5})$. **(2 marks)**

c Simplify $\dfrac{4 - 2\sqrt{3}}{5 + \sqrt{3}}$ giving your answer in the form $a + b\sqrt{c}$, where a, b and c are rational numbers. **(3 marks)**

5 The area of a triangle is given as $(16 + 4\sqrt{5})\,\text{cm}^2$.

The base of the triangle is $(7 - \sqrt{5})\,\text{cm}$, and the perpendicular height is $(p + q\sqrt{5})\,\text{cm}$.

Find the values of p and q. **(4 marks)**

6 Expand and simplify these expressions.

a $4(2x + 3y)$ **(1 mark)**

b $(3x - 1)(4x + 3)$ **(2 marks)**

c $(x + 1)^2(x - 3)$ **(3 marks)**

7 Fully factorise these expressions.

a $3x - 12xy$ **(1 mark)**

b $x^2 - 5x + 6$ **(1 mark)**

8 Solve these equations.

   a $2x + 15 = 7$ **(1 mark)**

   b $x^2 - 11x + 10 = 0$ **(2 marks)**

   c $3x^2 - 7x + 3 = 0$ **(2 marks)**

9 Solve these pairs of simultaneous equations.

   a $3x + y = 2$ **(3 marks)**
      $4x - y = -9$

   b $y = 4x + 3$ **(3 marks)**
      $2y = 2x + 3$

   c $x - y = 1$ **(4 marks)**
      $x^2 + y^2 = 13$

10 Solve these inequalities.

   a $3x + 5 \leqslant 12$ **(1 mark)**

   b $4x - 3 > 9x - 7$ **(2 marks)**

   c $x^2 + x - 56 \leqslant 0$ **(2 marks)**

11 The function f is defined as $f(x) = x^2 - 7$

   Find the value of $f(-3)$.   **(1 mark)**

This is the end of the test.

If having looked at these questions you feel there are things that you are not fully confident with, scan the QR code below that will take you to a series of videos that will be helpful in supporting you with these skills.

SCAN ME   SCAN ME

Shadow Baseline Solutions

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
1a	x^3	1	1st Recall and use the rules for positive integer indices.
1b	$9x^8$	1	1st Recall and use the rules for positive integer indices.
1c	$\dfrac{4x^{\frac{1}{3}}}{8x^{-\frac{9}{4}}}$	1	3rd Recall and use the rules for zero, fractional and negative indices.
	$= \dfrac{1}{2}x^{\frac{1}{3}+\frac{9}{4}}$	1	
	$= \dfrac{1}{2}x^{\frac{31}{12}}$	1	
		(5 marks)	

Notes
None

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
2	$6x^5 = 6144 \Rightarrow x^5 = 1024$	1	2nd Solve equations involving positive integer indices.
	$x = 4$	1	
		(2 marks)	

Notes
None

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
3	$x^{\frac{2}{3}} = 25$	1	4th Solve equations involving fractional and negative indices.
	$x = \pm 125$	1	
		(2 marks)	

Notes
Condone omission of $\pm$

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
4a	$8\sqrt{7}$	1	1st Simplify surds.
4b	$6 + 9\sqrt{5} - 2\sqrt{5} - 15$	1	3rd Expand pairs of brackets involving surds.
	$= -9 + 7\sqrt{5}$	1	
4c	$\dfrac{4 - 2\sqrt{3}}{5 + \sqrt{3}} \times \dfrac{5 - \sqrt{3}}{5 - \sqrt{3}}$	1	4th Rationalise the denominator of a fraction with a surd expression as denominator.
	$= \dfrac{20 - 4\sqrt{3} - 10\sqrt{3} + 6}{25 - 3}$	1	
	$= \dfrac{13}{11} - \dfrac{7}{11}\sqrt{3}$	1	
		(6 marks)	

Notes
None

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
5	$\frac{1}{2}(7-\sqrt{5})(p+q\sqrt{5}) = (16+4\sqrt{5})$	1	4th Solve problems involving surds in context and complete simple proofs involving surds.
	$p+q\sqrt{5} = \dfrac{32+8\sqrt{5}}{7-\sqrt{5}}$	1	
	$p+q\sqrt{5} = \dfrac{224+56\sqrt{5}+32\sqrt{5}+40}{44}$	1	
	$p+q\sqrt{5} = 6+2\sqrt{5} \Rightarrow p=6,\ q=2$	1	

(4 marks)

Notes

Alternative method:

$$\frac{1}{2}\left(7-\sqrt{5}\right)\left(p+q\sqrt{5}\right) = \left(16+4\sqrt{5}\right)$$
$$7p+7q\sqrt{5}-p\sqrt{5}-5q = 32+8\sqrt{5}$$
$$7p-5q+\sqrt{5}(7q-p) = 32+8\sqrt{5}$$

Hence: $7p-5q = 32$

$\qquad 7q-p = 8$

Now solve simultaneous equations to find $p=6,\ q=2$

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
6a	$8x+12y$	1	1st Expand single brackets.
6b	$12x^2+5x-3$	2*	2nd Expand the product of two brackets and simplify.
6c	$(x^2+2x+1)(x-3)$	1	3rd Expand the product of three brackets and simplify.
	x^3-x^2-5x-3	2*	

(6 marks)

Notes

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
7a	$3x(1-4y)$	1	1st Factorise linear expressions.
7b	$(x-3)(x-2)$	1	2nd Factorise simple quadratic expressions.
		(2 marks)	

	Notes		

None

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
8a	$x=-4$	1	1st Solve linear equations in one unknown.
8b	$(x-10)(x-1)=0$	1	2nd Solve simple quadratic equations by factorising.
	$x=10,\ x=1$	1	
8c	$x=\dfrac{7\pm\sqrt{49-36}}{6}$	1	3rd Solve quadratic equations by use of formula.
	$x=\dfrac{7}{6}\pm\dfrac{1}{6}\sqrt{13}$	1	
		(5 marks)	

	Notes		

None

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
9a	$7x = -7$	1	1st Solve linear simultaneous equations by elimination and substitution.
	$x = -1$	1	
	$y = 5$	1	
9b	$2(4x + 3) = 2x + 3 \Rightarrow 6x = -3$	1	1st Solve linear simultaneous equations by elimination and substitution.
	$x = -\frac{1}{2}$	1	
	$y = 1$	1	
9c	$x^2 + (x - 1)^2 = 13$	1	4th Find intersections of circles and straight lines.
	$2x^2 - 2x - 12 = 0 \Rightarrow x^2 - x - 6 = 0$	1	
	$x = 3,\ x = -2$	1	
	$y = 2,\ y = -3$	1	
			(10 marks)
Notes			
None			

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
10a	$x \leqslant \frac{7}{3}$	**1**	2nd Solve linear inequalities.
10b	$4 > 5x$	**1**	2nd Solve linear inequalities.
	$x < \frac{4}{5}$	**1**	
10c	$(x-7)(x+8) \leq 0$	**1**	4th Solve quadratic inequalities.
	$-8 \leqslant x \leqslant 7$	**1**	
			(5 marks)
Notes			
None			

Q	Scheme	Marks	Pearson Progression Step and Progress descriptor
11	$(-3)^2 - 7 = 2$	**1**	3rd Understand and use function notation.
			(1 mark)
Notes			
None			

Candidate surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

Candidate Number

Summer 2024

Time: 1 hour

Paper Re 9MA0/PT1   /01

Mathematics

Practice test
A level questions for GCSE Higher tier

You must have:
Calculator

Total Marks

Candidates may use any calculator allowed by Pearson regulations.

Calculators must not have the facility for symbolic algebra

manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams / sketches / graphs it must be dark (HB or B).
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- You should show sufficient working to make your methods clear.
  Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- There are 19 questions in this question paper. The total mark for this paper is 53.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

1. (*a*) Find the value of $3x^3 + 2ax^2 - 4x + 5a$ when $x = -3$.

(2)

(*b*) Find the value of *a* when $69 + 23a = 0$.

(1)

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2. Three Bags, *A*, *B* and *C*, each contain 1 red marble and some green marbles.

      Bag *A* contains 1 red marble and 9 green marbles only
      Bag *B* contains 1 red marble and 4 green marbles only
      Bag *C* contains 1 red marble and 2 green marbles only

Sasha selects at random one marble from Bag *A*.
If he selects a red marble, he stops selecting.
If the marble is green, he continues by selecting at random one marble from Bag *B*.
If he selects a red marble, he stops selecting.
If the marble is green, he continues by selecting at random one marble from Bag *C*.

(*a*) Draw a tree diagram to represent this information.

(2)

(*b*) Find the probability that Sasha selects 3 green marbles.

(2)

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3. (*a*) Rearrange the equation $1 - \dfrac{x^2}{2} - 2x - \dfrac{1}{2} = 0$ into the form $ax^2 + bx + c = 0$.

(1)

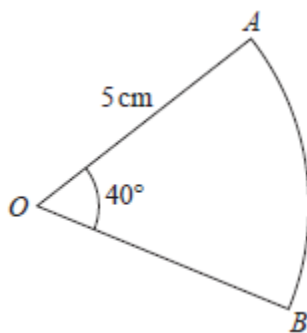(*b*) Solve the equation found in part (*a*).

(1)

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4. Show that $\dfrac{(x+1)^2 \times (10x+10) - (5x^2 + 10x) \times 2(x+1)}{(x+1)^4} = \dfrac{A}{(x+1)^n}$ where *A* and *n* are integers to be found.

(2)

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5. Find the area of the sector *AOB*.
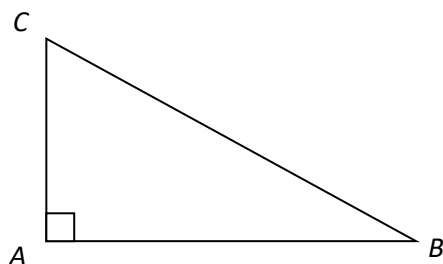

(2)

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6. (*a*) Find *x* when $\dfrac{4-3x}{1+2x} = -\dfrac{4}{3}$

(2)

(*b*)

The diagram shows a right-angled triangle *ABC* where $AB = x^2 - x$ and $AC = \dfrac{3}{2}x^2 - 4x$.

Find the distance *BC* when *x* = 4.

(2)

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7. (*a*) Write $f(x) = 2x^2 + 4x + 9$ in the form $a(x + b)^2 + c$.

(3)

(*b*) Sketch the curve with equation $y = 2x^2 + 4x + 9$, showing any points of intersection with the coordinate axis and the coordinates of any turning point.

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8. Find x when $10 (\cos x)^2 = 9, \quad 0° < x < 90°$.

(2)

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9. Magali is studying the mean total cloud cover, in oktas, using data from the large data set. The daily mean total cloud cover for all 184 days from the large data set is summarised in the table below.

Daily mean total cloud cover (oktas)	0	1	2	3	4	5	6	7	8
Frequency (number of days)	0	1	4	7	10	30	52	52	28

One of the 184 days is selected at random.

(*a*) Find the probability that it has a daily mean total cloud cover of 6 or greater.

(1)

There were 28 days that had a daily mean total cloud cover of 8. For these 28 days the daily mean total cloud cover for the **following** day is shown in the table below.

Daily mean total cloud cover (oktas)	0	1	2	3	4	5	6	7	8
Frequency (number of days)	0	0	1	1	2	1	5	9	9

(*b*) Find the proportion of these days when the daily mean total cloud cover was 6 or greater.

(1)

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10. (*a*) Solve the simultaneous equations

$$x + 880y = 1100$$

$$x + 300y = 680$$

(1)

(*b*) Find the least value of n when $2n - (428 + 0.84n) > 0$

(1)

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11. (*a*) Expand and simplify $y = x(x + 2)(x - 4)$.

(1)

(*b*) Find the value of $\dfrac{1}{4}x^4 - \dfrac{2}{3}x^3 - 4x^2$ when $x = 2$.

(1)

(*c*) Expand and simplify $y = (x + 2)^2(3x^2 - 20x + 20)$.

(2)

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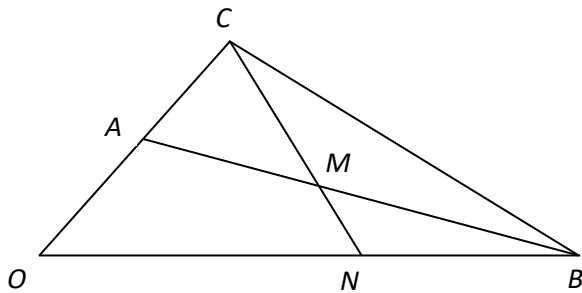**12.** Given that $a - b = \dfrac{a}{b}$, show that $a = \dfrac{b^2}{b - 1}$.

(2)

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13. Work out how far a car moving at 60 km h^{-1} travels in 0.8 seconds, giving your answer in metres.

(1)

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14. If n is an integer greater than 1, show, by considering both odd and even numbers, that $n^2 + 2$ is not divisible by 4.

(4)

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15.

The diagram shows a sketch of triangle *OAB*.

The point *C* is such that $\overrightarrow{OC} = 2\,\overrightarrow{OA}$.

The point *M* is the midpoint of *AB*.

The straight line through *C* and *M* cuts *OB* at the point *N*.

Given $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$, find $\overrightarrow{CM}$ in terms of **a** and **b**.

(2)

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16. Use the iteration formula

$$x_{n+1} = 2x_n^{1-x_n}$$

with $x_1 = 1.5$ to find x_4 to 3 decimal places.

(2)

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17. (*a*) A runner finishes a race in $24 + (6 \times 1.05) + (6 \times 1.05^2)$ minutes. Find this time in hours, minutes and seconds.

(1)

(*b*) A runner finishes a race in $24 + 6.3 \times \dfrac{(1.05^{16} - 1)}{1.05 - 1}$ minutes. Find this time in hours, minutes and seconds.
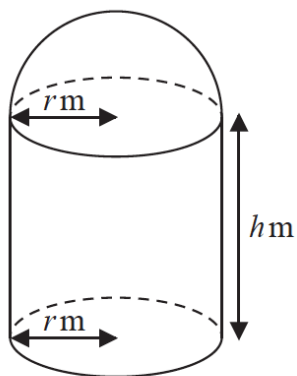
(2)

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18. $y = \dfrac{p - 3x}{(2x - q)(x + 3)}$. Find the value of *p* when $y = \dfrac{1}{2}$, $x = 3$ and $q = 4$.

(2)

19.

[A sphere of radius r has volume $\dfrac{4}{3}\pi r^3$ and surface area $4\pi r^2$]

A manufacturer produces a storage tank modelled in the shape of a hollow circular cylinder closed at one end with a hemispherical shell at the other end as shown in the diagram above.

The cylinder has radius r metres and height h metres and the hemisphere has radius r metres.

The volume of the tank is 6 m³.

Show that the surface area of the tank, in m², is given by

$$\frac{12}{r} + \frac{5}{3}\pi r^2$$

(4)