A level Mathematics (9MA0) Summer Task

Pupils Name:_____

- All pupils opting to study Mathematics or Further Mathematics at A level will be required to complete all of this "A level Mathematics (9MA0) Summer Task Booklet" over the summer holiday in preparation for the A level course starting in September.

- All practice questions should be fully attempted.

- Please make sure that your completed booklet is handed into Mr Virciglio on the first day back in September.

- We look forward to welcoming you onto the course after your summer break

Mathematics Department (Davenant Foundation School)

Contents:

I. RAG

For each of the following topics RAG rate yourself based on what you know from GCSE. Then complete the booklet and redo at the end. Having a secure understanding of these topics will mean that you are in the best possible position to start your A Level course.

Topic	Red	Amber	Green
Solving quadratics			
Changing the subject			
Simultaneous equations			
Surds			
Indices			
Properties of lines			
Sketching curves			
Transformations of functions			
Pythagoras			
Sine/Cosine Rule			
Inequalities			
Proof			
Vectors			
Probability			

Basic Skills Check Section:

1. Expand the brackets: i) $(2x-4)(-4+x)$

   ii) $(x-5)(2x-4)(3-x)$

2. Given $f(x)=x^2+5x-2$ find the value of $f(-4)$

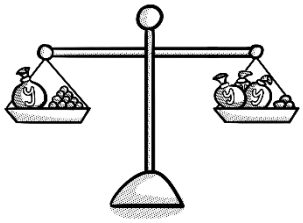
3. Solve the simultaneous equations.

   $3x-4y=20$

   $5x+5y=10$

4. Solve each of these equations.

   (i) $4x-3=15$

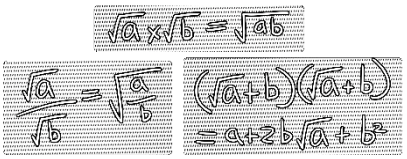
   (ii) $\frac{y}{3}+4=9$

   (iii) $5m-8=2m+13$

   (iv) $\frac{1+2x}{5}-\frac{5+3x}{4}=\frac{x-4}{2}-5$

5. Simplify $\left(3+\sqrt{2}\right)\left(3-\sqrt{2}\right)$

6. Express $\frac{1+\sqrt{2}}{3-\sqrt{2}}$ in the form $a + b\sqrt{2}$ where a and b are rational.



7. Simplify $\frac{(x^2y^3z)^5}{4y^2z}$

8. A (0,2), B (7,9) and C (6,10) are three points.

   (i) Show that AB and BC are perpendicular.

   (ii) Find the length of AC.

9. Sketch the graph of $y = 9 - x^2$

10. The curve $y = x^2 - 4$ is translated by $\binom{2}{0}$

    Write down an equation for the translated curve. You need not simplify your answer.

11. Given that $cos\theta = \frac{1}{3}$ and θ is acute, find the exact value of $tan\theta$.

12. Solve

(i) $x^2 - 36 \leq 0$

(ii) $9x^2 - 25 \geq 0$

(iii) $3x^2 + 10x < 0$

13. Prove that the square of an odd number is also odd.

14. Caleb either walks to school or travels by bus.

The probability that he walks to school is 0.75

If he walks to school, the probability that he will be late is 0.3

If he travels to school by bus, the probability that he will be late is 0.1

Work out the probability that he will not be late.

15. Find the exact solutions of $x+\frac{5}{x}=12$.

16. Make y the subject of $x=\frac{2-7y}{y-5}$.

17. Solve $\frac{4}{x}-\frac{3}{2x-1}=1$

18. Show that $3+\left[(x+4)\div\frac{x^2-x-20}{x+1}\right]$ simplifies to $\frac{ax-b}{cx-d}$ where a, b, c and d are integers.

19. Make x the subject of each formula

$y = \frac{x^2+1}{n}$ $\quad z = 1+\frac{n}{x^2}$ $\quad k = \frac{1}{4}(x-1)^2$

20. Solve these simultaneous equations.

$$2x+y=5$$
$$x^2+2x=y$$

Problem Solving Section:

1. Two numbers have a product of 44 and a mean of 7.5

   Use an algebraic method to find the numbers.

   You must show all your working.

2. In a parallel circuit, the total resistance is given by the formula $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

   Make R_1 the subject of the formula

3. Arthur and Florence are going to the theatre.
   Arthur buys 6 adult tickets and 2 child tickets and pays £39
   Florence buys 5 adult tickets and 3 child tickets and pays £36.50
   Work out the costs of both adult and child tickets.

4. Colin has made a mistake in his 'simplifying surds' homework. Explain his error and give the correct answer.

$$4\sqrt{3} \times 5\sqrt{12} = 20\sqrt{36}$$

5. Below is a sketch of $f(x)$.

   The coordinates of P are (0,-2)

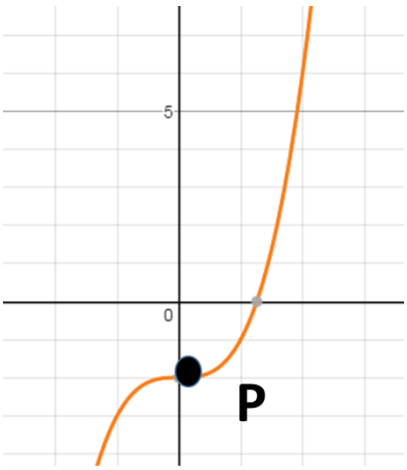
   State the coordinates of P after each translation:

   (i) $g(x) = f(x) + 1$

   (ii) $h(x) = f(x - 2)$

   (iii) $j(x) = -f(x)$

   (iv) $k(x) = f(-x)$



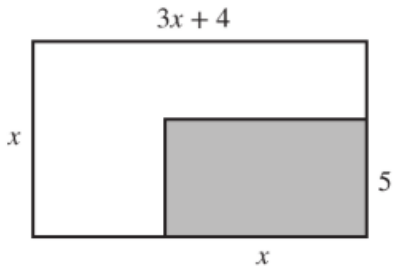
6. The equation of a curve is $y = f(x)$ where $f(x) = x^2 - 4x + 5$
   C is the minimum point of the curve.
   (i) Find the coordinates of C after the transformation $f(x + 1) + 2$

   (ii) Determine if $f(x - 3) - 1 = 0$ has any real roots.
   Give reasons for your answer.

7. A piece of land is the shape of an isosceles triangle with sides 7.5m, 7.5m and 11m.
Turf can be bought for £11.99 per $5m^2$ roll.
How much will it cost to turf the piece of land?

8. A farmer has a triangular field. He knows one side measures 450m and another 320m. The angle between these two sides measures 80^o. The farmer wishes to use a fertiliser that costs £3.95 per container which covers $1500m^2$. How much will it cost to use the fertiliser on this field?

9.



The diagram shows a large rectangle of length $(3x+4)$ cm and width x cm. A smaller rectangle of length x cm and width 5 cm is cut out and removed.
The area of the shape that is left is $70\,cm^2$.

Form a quadratic equation from this information in the form $\boldsymbol{ax^2 + bx + c = 0}$

10. The Venn diagram shows the ice-cream flavours chosen by a group of 44 children at a party.

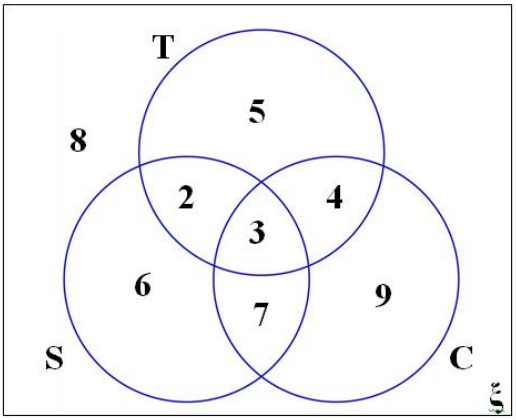
The choices are strawberry (S), choc-chip (C) and toffee (T). A child is picked at random.

Work out:

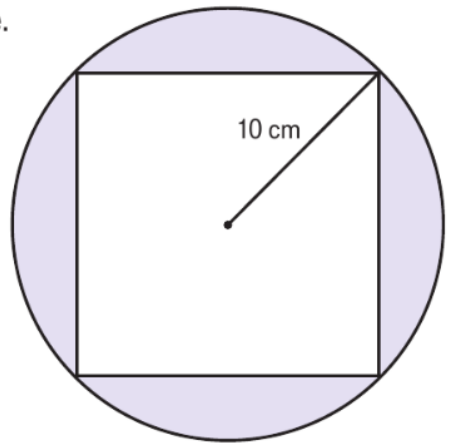
(i) $P(S)$

(ii) $P(T \cap C|C)$

(iii) $P(C|S \cup T)$



11. **Problem-solving** The diagram shows a square inside a circle.
All four vertices of the square lie on the circle.
The radius of the circle is 10 cm.
Work out the total area of the shaded regions.
Give your answer correct to 3 significant figures.



ANSWERS (Please self-asses your progress) - Basic Skills Check Section:

1)i) $2x^2 - 12x + 16$ **ii)** $-2x^3 + 20x^2 - 72x + 60$ **2)** *-6* **3)** *x = 4, y = - 2*

4)i) *x = 9/2 or 4.5* **ii)** *y = 15* **iii)** m = 7 **iv)** *x = 7* **5)** *7* **6)** $\frac{5}{7} + \frac{3}{7}\sqrt{2}$

7) $(x^{10}y^{13}z^4)/4$ **8) i)** 1 × -1 = -1 hence perpendicular **ii)** *10*

9) *upside down parabola with roots at -3 and 3 and y-intercept at 9*

10) $y = (x-2)^2 - 4$ **11)** $2\sqrt{2}$ **12)i)** $-6 \leq x \leq 6$ **ii)** $\boldsymbol{x \geq \frac{5}{3}}$ or $\boldsymbol{x \leq -\frac{5}{3}}$ **iii)** $0 < x < \frac{10}{3}$

13) Proof **14)** *0.75* **15)** $6 \pm \sqrt{31}$ **16)** $y = \frac{2+5x}{x+7}$ **17)** *x = 2, x = 1*

18) *a = 4, b = 14, c = 1, d = 5* **19)** $x = \sqrt{ny - 1}$, $x = \sqrt{\frac{n}{z-1}}$, $x = 2\sqrt{k} + 1$

20) *x = -5, y = 15 and x = 1, y = 3*

ANSWERS (Please self-asses your progress) – Problem Solving Section:

1) *4* & 11 **2)** $R_1 = \frac{RR_2}{R_2 - R_1}$ **3)** *a = 5.50, c = 3.00* **4)** *120*

5)i) *(0 , -1)* **ii)** *(2 , -2)* **iii)** *(0 , 2)* **iv)** *(0 , -2)* **6)i)** *(1 , 3)* **ii)** *one equal (or double root) see sketch!* **7)** *6 rolls needed = £71.94* **8)** *48 containers needed = £189.60*

9) *a = 3, b = -1, c = -70* **10)i)** *18/44* **ii)** *7/23* **iii)** *10/27* **11)** *114cm²*

Extra Practice

1. **Exam style practice.** For each of the topics you should watch the video, and then answer the exam questions and mark your answers. Where have you made mistakes? Is there something you need to do more work on?

   Algebraic fractions
   http://www.mathsgenie.co.uk/algebraic-fractions.html
   http://www.mathsgenie.co.uk/resources/algebraic-fractions.pdf

   Forming equations
   http://www.mathsgenie.co.uk/forming-and-solving-equations.html
   http://www.mathsgenie.co.uk/resources/64_forming-and-solving-equations.pdf

2. **Complete 30 questions from the 'quadratics' section on completing the square and factorising.**
   http://www.kangaroomaths.com/kenny4.php?page=Kmathsinfinity

3. **Watch the video and then complete the tasks at the end.**
   https://library.leeds.ac.uk/skills-algebra

4. **Complete the A Level transition questions.**
   https://gryphonmaths.wordpress.com/a-level/transition/task-1/

5. **Underground Mathematics**
   This resource is FULL of lots of tasks and challenges. If you are feeling less confident with a topic then use the '*building block'.* If you want more of a challenge then carry out one of the '*fluency exercise'.*
   https://undergroundmathematics.org/

Exciting and Interesting Bits!

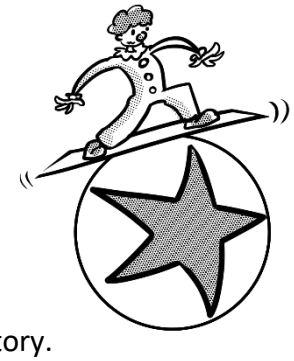
Below are some articles and videos to view.
These are all going to extend your understanding of maths in the real world.

1. **Follow the 'WATCH, THINK, DIG DEEPER, DISCUSS'**
   The Wizard standoff riddle.
   https://ed.ted.com/lessons/can-you-solve-the-wizard-standoff-riddle-daniel-finkel

2. **Follow the 'WATCH, THINK, DIG DEEPER, DISCUSS'**
   Solve the false positive riddle.
   https://ed.ted.com/lessons/can-you-solve-the-false-positive-riddle-alex-gendler

3. **Read the notes on the page and carry out the algebraic investigation. Complete the worksheet included.**
   https://www.teachmathematics.net/page/7566/oxo

4. **Create a PINTREST board with images of maths in nature. Investigate the maths behind some of the images you have found.**



5. **Maths Magic.**
   Can you create your own version of the problem? Investigate other magic tricks which are based around maths.
   https://nrich.maths.org/1051

6. **Golden Ratio Day**
   Golden ratio day is 1st June 2018. Investigate the golden ratio and its history.
   https://www.teachengineering.org/activities/view/nyu_phi_activity1
   https://www.quora.com/How-is-the-golden-ratio-useful-to-students
   Find more articles on this and create a poster all about the golden ratio.

7. **Complete module 1- Advanced Problem Solving**
   https://nrich.maths.org/10209

RAG

Complete a RAG rating for the key topics from this booklet. Remember if you are still unsure on any of these topics then look them up for further help and support.

GOOD LUCK!

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