Year 9 Mathematics Examination Preparation Sheet 2018

General Information for Candidates

In Year 9, the end-of-year assessment in mathematics consists of two 90-minute examinations, which will be given equal weighting on your end-of-year report. Paper 1 is a non-calculator paper; paper 2 is a calculator paper. Each paper is worth a total of 100 marks.

You will need a ruler, a blue/black pen, a pencil, an eraser, a protractor and compasses for both papers, and obviously a scientific/mathematical calculator for the second one. (The recommended CASIO FX83GT Plus models are available from your mathematics teacher for £8.)

You will be writing your answers on the question paper in the spaces provided. There will be enough space to set out your method clearly in the way that your teacher has shown you in class. You need to realise that **VERY FEW MARKS WILL BE AWARDED FOR MERELY WRITING DOWN A CORRECT ANSWER WITH NO INDICATION OF METHOD.** We are **not** looking for rough jottings – we want to see that you can follow the procedures and formal mathematical layout that your teacher has shown you during the year. This applies just as much to the calculator paper as to the non-calculator paper.

The practice questions below are similar to those you will be expected to answer.

NON-CALCULATOR PAPER
You must write down all stages in your working.

1. A painting used to sell for £150. It is reduced in price by 40%.
   How much does it sell for now?

2. A television was bought for £75 and sold for £96.
   Calculate the percentage profit.

3. After a 10% increase, some shoes are priced at £59.40.
   How much were they before?

4. In Physics, the Fine Structure constant is approximately 0.007 3.
   Write this number in standard form.

5. The population of China is about 1 520 000 000.
   Write this number in standard form.

6. Work these out, leaving your answers in their simplest forms:
   (a) $3\frac{2}{5}+\frac{1}{3}-\frac{1}{6}$
   (b) $5\frac{5}{8}-1\frac{1}{3}$
   (c) $\frac{16}{3}\times\frac{5}{6}\div\frac{8}{9}$
   (d) $1\frac{2}{3}\times\frac{4}{5}+\frac{8}{9}$
   (e) $5\frac{3}{4}-2\frac{1}{4}\times1\frac{1}{3}$

7. (a) Find an expression for the nth term of this arithmetic sequence: 7, 13, 19, 25, …
   (b) What is the 25th term?

8. Work out the first 5 terms of the quadratic sequence given by this expression:
   n^{th} term $= 2n^2 + 3$

9. Solve these simultaneous equations:
   (a) $3x - 3y = 6$
   $4x + 3y = 15$

   (b) $5x + 3y = 31$
   $4x - 5y = 10$

10. The new HS2 rail-link plan has some rail lines **above** ground, and some **cut-and-cover** tunnels, (which is supposedly a cheap way to hide the railway from sight). The Government has suggested that along a 15 mile stretch of the Chiltern Hills they could have 5 miles of cut-and-cover tunnels and 10 above ground, at a cost of £2 Billion; a local group has proposed a plan which has 10 miles of cut-and-cover and so only 5 miles of above ground lines which would cost £2.2 Billion in total.
   If the cost in £Billion per mile of laying **above ground track is** a, and the cost in £Billion per mile of **cut-and-cover track is** c, form a simultaneous equation and solve it to find the cost of each type of track, per mile.

11. Work out:
    (a) $30 \times (-4)$
    (b) $(-16) + (-25)$
    (c) $(-45) \div (-15)$
    (d) $(-5) \times 3$
    (e) $8 - (-15)$

12. Work out:
    (a) $20 - 7 \times 2 - 3$
    (b) $\dfrac{3 \times 6^2}{6 - 2}$
    (c) $\dfrac{10 - 4}{3 \times 2^2}$
    (d) $18 - 6 \div 3 - 2 + 1$

13. Work out:
    (a) $349 + 257$
    (b) $503 - 78$
    (c) $51 - 34.547$
    (d) 686×57
    (e) 1.36×9.5
    (f) $3.05 \div 2.5$
    (g) $21.352 \div 3.4$
    (h) $39.732 \div 6.6$

14. Factorise the following quadratic expressions:
    (a) $x^2 + 4x + 3$
    (b) $x^2 + 7x + 10$
    (c) $x^2 - 5x - 24$

15. Simplify:
    (a) $\dfrac{6}{b} - \dfrac{5}{2b}$
    (b) $\dfrac{1}{2d} + \dfrac{3}{d^2}$
    (c) $\dfrac{4}{r} \times \dfrac{3r^2}{5}$
    (d) $\dfrac{5f}{2} \times \dfrac{6}{25f}$

16. Factorise fully:
    (a) $24z^2 + 8yz$
    (b) $9p^2 - 3p$
    (c) $4w^3r^2 + 6w^2r^4$
    (d) $3p^6qr^2 - 12pq^5$

17. Expand:
    (a) $5(6 - b)$
    (b) $8(2s + 5)$
    (c) $10(3q - 1)$
    (d) $-3(t - 4)$

18. Expand and simplify:
    (a) $4(2 - 6h) + 3(h + 1)$
    (b) $3(2u + 7) - 2(5 - u)$
    (c) $(t + 4)(t - 1)$
    (d) $(y + 5)^2$

19. Abdullah thinks of a number, a, multiplies it by 5 and subtracts 23. His answer is 12.
    (a) Write down an equation for Abdullah's number.
    (b) Solve the equation to work out Abdullah's number.

20. Simplify fully:
    (a) $32 : 8 : 12$
    (b) $25 \text{ mm} : 1 \text{ m}$
    (c) $1.2 \text{ litres} : 40 \text{ cm}^3$
    (d) $1\dfrac{1}{5} : 1\dfrac{1}{2}$

21. Use any of the symbols $+ - \times \div$ (as many times as you wish) to complete each of the following equations:
    (a) $4 \quad 5 \quad 6 \quad = 34$
    (b) $5 \quad 6 \quad 7 \quad = 6$

22. Plot the following lines onto an x-y axis: (a) y = 4x+1   (b)   3x+2y = 12   (c)   y=-0.5x+1

23. State the gradient and the *y*-intercept of each of the following lines:
(a) $y = 5x + 1$ (b) $4y = 2x - 3$ (c) $x + y = 12$ (d) $6x = 2y + 7$

24. A Year 9 pupil weighed the amount of paper and card recycled in 50 form rooms in one week. The results are shown in the table.

| mass (*m* g)	frequency
$0 \le m < 500$	9
$500 \le m < 1000$	10
$1000 \le m < 1500$	13
$1500 \le m < 2000$	14
$2000 \le m < 2500$	3
$2500 \le m < 3000$	1

(a) Make a cumulative frequency table for these results.
(b) Choosing sensible scales, draw an accurate cumulative frequency curve for this data.
    (Remember to plot cumulative frequency at the *upper* limit of each category.)
(c) From your graph, estimate the median amount of paper recycled.
(d) Find an estimate for the interquartile range.

25. Solve the equations:
(a) $38 - 4y = 10$ (b) $3(u + 5) - 1 = 5u + 2$ (c) $\frac{2}{5}(9g - 8) = 22$ (d) $\frac{3}{4}(3w - 2) + \frac{1}{3}(2w + 1) = 28$

26. Work out, leaving your answers in their simplest forms,
(a) $\frac{7}{9} \times \frac{3}{55} \times \frac{11}{14}$ (b) $\frac{2}{5} + \frac{1}{3} - \frac{1}{6}$ (c) $5\frac{5}{8} - 1\frac{1}{3}$ (d) $1\frac{5}{6} - \frac{8}{9}$ (e) $\frac{16}{3} \times \frac{5}{6} \div \frac{8}{9}$

27. When George looks up to the top of the *British Telecom* Tower in London (pictured), the angle of inclination is 25°. When he moves 200 metres closer and does it again, the angle increases to 43°.
(a) Use this information to draw an accurate scale diagram.
    (Assume that George's eyes are 1.5 metres above the ground.)
(b) From your diagram, estimate the height of the *BT* Tower.

28. Work these out, giving your answer in standard form:
(a) $(2 \times 10^7) \times (2.2 \times 10^5)$
(b) $(3 \times 10^2) \times (2.5 \times 10^{14})$
(c) $(3 \times 10^9) \times (5 \times 10^{-4})$
(d) $(6 \times 10^4) \div (2 \times 10^2)$
(e) $(2 \times 10^3) \div (8 \times 10^{-4})$

29. Piers measures his own height and tells Sarah he is 170cm tall.
Write down Pier's height as a range of values if he measures to:
(a) the nearest 10cm.
(b) the nearest 1cm.

30. (a) Use your calculator to evaluate $\dfrac{612 \times 0.35}{(5.41 - 2.93)^2}$.

      (i) Write down all the figures on your calculator display.

      (ii) Now round your answer to 3 significant figures and write it down.

   (b) Syrus has forgotten his calculator, so he works out an approximate answer on paper.

      (i) Round all the numbers in the calculation for a rough check and write down the calculation

        that Syrus should do *without* a calculator: $\dfrac{? \times ?}{(? - ?)^2}$

      (ii) Work out the answer that Syrus should get.

31. Charuky opens a savings account with 1.5% interest per year. She deposits £750 and there are no further transactions for 4 years. To the nearest penny, how much is in the account after this time?

32. Work out   (a) $\frac{3}{8}$ of £43.36   (b) 24% of 65 litres

33. A 'cylindrical' Swiss roll has a diameter of 8 cm and a length of 25 cm.

   (a) Work out the volume, giving your answer correct to 3 significant figures.

   (b) Work out the total surface area, giving your answer correct to 3 significant figures.

34. (a) Express the following numbers as products of their prime factors:

      (i) 60   (ii) 96

   (b) Use your prime factorisations to find the **Highest Common Factor (HCF)** of 60 and 96.

   (c) Use your prime factorisations to find the **Lowest Common Multiple (LCM)** of 60 and 96.

35. Illustrate the following ranges of values on separate number lines.

   (a) $2.7 \leq x < 3.1$ (b) $0.03 < x < 0.1$ (c) $-3 \leq x \leq -2$ (d) $1.89 < x \leq 1.9$

   For each inequality, state **one** number that lies within the range.

36. An electrician uses the formula $d = \dfrac{N}{An}$.

   Use the values $N = 1.873 \times 10^{13}$, $A = 2.0 \times 10^{-4}$ and $n = 8.49 \times 10^{28}$ to work out d.

   Give your answer in standard form correct to 2 significant figures.

37. The shaded shape on the right is called an 'arbelos'. It is formed by cutting two semicircles (with diameters 8 cm and 6 cm) out of a semicircle with diameter 14 cm.

   (a) Calculate the **perimeter** of the arbelos.

   (b) Calculate the **area** of the arbelos.

   Give your answers correct to 1 decimal place.

38. Simplify as powers of 5:

   (a) $5^6 \times 5^2$ (b) $5^6 \div 5^2$ (c) $5^6 \times 5^{-2}$ (d) $5^6 \div 5^{-2}$

39. Are there more seconds in a year or hours in a thousand years? Explain your answer clearly.

40. Find the value of x and y. *(Post-Easter topic)*
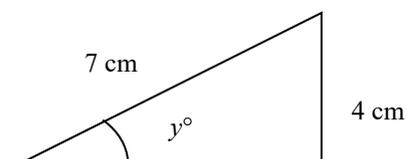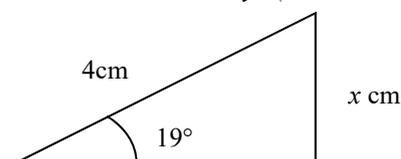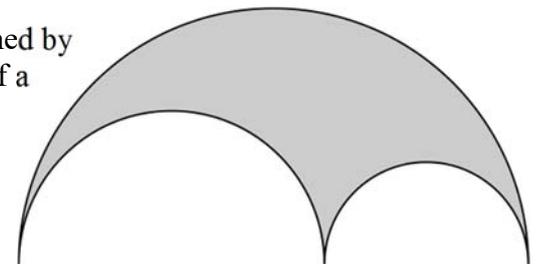
41. It is known that y is proportional to x^2. When $x = 4$, $y = 20$. Find an expression for y in terms of x.

42. (a) Make a table of values for the equation $y = x^2 - 5x + 1$ for values of x from -1 to 6.
    (b) Plot your points and make an accurate drawing of the graph.
       (Make your y-axis go from -10 to 10.)
    (c) Use your graph to solve the equation $x^2 - 5x + 1 = 0$.
       Give **both** of your answers correct to 1 decimal place.

43. Two sides of a right-angled triangle are 15 m and 40 m long.
    (a) Explain, with a sketch, why there are **two** possible lengths for the third side.
    (b) Work out **both** possible answers, giving them correct to 1 decimal place.

44. The pupils in one Year 9 form group timed how long it took them to travel from one classroom to another during a lesson changeover.
The results are shown in the table.

time (t minutes)	frequency
$0 \leq t < 1$	4
$1 \leq t < 2$	9
$2 \leq t < 3$	6
$3 \leq t < 4$	1
$4 \leq t < 5$	0
$5 \leq t < 6$	1

Add two more columns to the table and use them to calculate an estimate for the **mean** amount of time taken. Give your answer in minutes and seconds.

45. Make x the subject of these equations.

    (a) $j = 7px$ (b) $r^2 = 10 - x$ (c) $k^2 = x^2 + 9u^2$ (d) $g = \dfrac{3}{x}$

46. A hexacontagon is a polygon with 60 sides.
    (a) Work out the sum of its **interior** angles.
    (b) Work out the sum of its **exterior** angles.
    Explain your answers clearly.

47. A certain regular polygon has each of its interior angles equal to 179°.
How many sides must the polygon have?

48. During heavy rain, the amount of rainfall r (in mm) is approximately proportional to the **square root** of the time t (in minutes).
After 20 minutes, 29 mm of rainfall is measured.
    (a) Find an equation for r in terms of t.
    (b) Use your equation to find the amount of rainfall predicted after 30 minutes.

49. In the shape *ABCD* below, *AB* is parallel to *CD* and the distance between the parallel lines is 30 m.
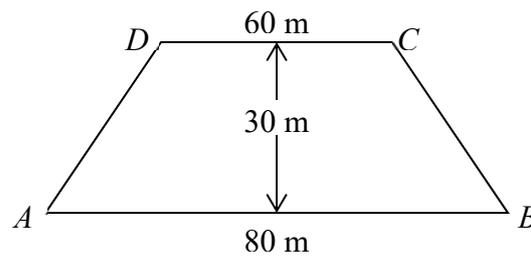

Diagram **NOT** accurately drawn

(a) Calculate the area of the shape.
In an **enlargement** of *ABCD*, the **new** side corresponding to *AB* has a length of 100 m.
(b) Find the **new** length of the other parallel side and the **new** distance between the parallel lines.
In the **enlarged** shape, one of the sloping sides has length 50 m.
(c) Calculate the length of this side in the **original** shape.

50. The lines $x = 3$, $y = 0$ and $y = 2x$ make a right-angled triangle. (The following is a post-Easter topic)
(a) Make a sketch and use trigonometry to calculate the two acute angles in the triangle.
The positive *y*-axis represents the North direction and the positive *x*-axis the East direction.
(b) Use your answer to part (a) to find the bearing of the position (3, 6) from the origin.
(c) What is the bearing of the origin from the position (3, 6)?

51. Tom drives 5 km on a bearing of 160°.
Daya starts from the same point but, instead of going directly, he travels
East for a distance a km and then South for a distance b km.

Tom and Daya arrive at exactly the same place.
Make a sketch and then use trigonometry to calculate the distances a and b.

52. The function f(x) is defined by $f(x) = 2^x$
(a) Find the value of f(10).
(b) Sketch the curve $y = 2^x$

53. The function $g(x)$ is defined by $g(x) = x^2 + 3x - 6$
Plot the curve $y = g(x)$ for values of $-6 \leq x \leq 3$.
To help you plot this, create a table of x -values from -6 to +3.
The y-axis should go from -12 to +12.

54. The volume of a sphere, of radius r, is given by the following formula: $V = \frac{4}{3}\pi r^3$

The Volume of a cylinder of radius r, with height h is given by: $V = \pi r^2 h$

Find (a) Find the volume of a cylinder with diameter 3cm and height 10cm
(b) Find the volume of a sphere which has a radius of 1.25mm
(c) Tom takes a cylinder made from play-dough of height 9cm and radius 5cm and rolls into a ball (sphere). What is the radius of the sphere?

55. Convert the following units:

    (a) $20cm^2$ to m^2
    (b) $3000cm^3$ to m^3
    (c) $2m^2$ to cm^2

56. James ran 200metres in 0.75minutes, what was his speed in metres per second?

57. Michael claimed he could run faster than James, Michael ran 500 metres in 2 minutes. Was he correct?

58. If I drive at a constant speed of 65mph, how long would it take me to drive to Glasgow, which 308 miles away?

57. The density of gold is 19.32grams per cubic centimetre. How much would the following amounts weight?

    (a) $20cm^3$
    (b) $0.05m^3$

58. A supermarket is offering shampoo in tow size bottles, a 200ml bottle for £1.25 and a 450ml bottle for £2.80. Which bottle is better value?

59. Cotton is sold at a cost of 59p per metre, I need to buy 70cm. How much will it cost me?