GCSE MATHEMATICS

S21-C300

Non-Calculator Assessment Resource N

Higher Tier

Formula list

Area and volume formulae

Where r is the radius of the sphere or cone, l is the slant height of a cone and h is the perpendicular height of a cone:

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Kinematics formulae

Where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

1. In 2018, the total volume of ice in the Greenland ice sheet was $2{\cdot}99 \times 10^6$ km^3.
The total surface area of the ice sheet was $1{\cdot}799 \times 10^6$ km^2.

Assuming that the depth of the ice was constant for the whole ice sheet, **estimate** the depth of the ice in 2018.
You must state the units of your answer. [3]

total volume $= 2.99 \times 10^6$

total surface area $= 1.799 \times 10^6$

depth $= \frac{2.99 \times 10^6}{1.799 \times 10^6} = 1.662034446\ldots \approx 1.66$ (3sf)

Depth of ice = 1.66 Units km

2. *(a)* Delyth borrows £3450 from a family member who charges her 2% per year simple interest.
She pays all the money back in one payment after 1 year 3 months.

How much interest does Delyth pay? [3]

3 months $= \frac{3}{12} = \frac{1}{4} = 0.25$

$1 + 0.25$

1.25

$3450(1 + 0.02)$

$= 3536.464556$

$\therefore \quad 3536.46 - 3450 = 86.46$

Interest £ 86.46

(b) Aiden invested £65 for 5 years at a rate of r% simple interest per year.
No extra money was paid in and no money was withdrawn during these 5 years.
At the end of the 5 years he received £9.75 interest in total.

Find the value of r. [3]

$65 \times \frac{r}{100} \times 5 = 9.75$

$\frac{r}{100} = \frac{3}{100}$

$r = 3$

$r =$ 3 %

3. Shania has two pieces of ribbon.

One piece is $5\frac{1}{4}$ metres long.

The difference between the lengths of the two pieces is $2\frac{9}{20}$ metres.

Work out the **two** possible lengths of the other piece of ribbon.
Give each of your answers as a mixed number in its simplest form. [4]

1 piece = $5\frac{1}{4} = 5.25$ m long

2nd piece is $5\frac{1}{4} + 2\frac{9}{20}$

$= \frac{21}{4} + \frac{49}{20} = \frac{105+49}{20} = \frac{154}{20} = \frac{77}{10}$

OR

$\frac{21}{4} - \frac{49}{20} = \frac{105-49}{20} = \frac{56}{20} = \frac{14}{5}$

∴ Ribbon = $7\frac{7}{10}$ m or $2\frac{4}{5}$ m

4. Huw has a maths test.

(a) For the first question, Huw divides 752 by a whole number.
His answer, which is correct, is 25 remainder 27.

What whole number did Huw divide by? [3]

$752 - 27 = 725$ | $25 \overline{)725}$ = 29 or $\begin{cases} x \times 25 + 27 = 752 \\ 25x = 725 \\ x = 29 \end{cases}$

Huw divided by 29

(b) The second question is:

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The only food provided for guests at Seaview Hotel is
breakfast. The hotel has enough food to make breakfast for
20 guests for 6 days.
How long would the food last 30 guests?
You may assume each guest eats the same amount of food
for breakfast.
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Here is Huw's working.

20 guests	for	6 days
10 guests	for	3 days
30 guests	for	9 days

(i) Without working out the correct answer, explain why Huw's answer of 9 days is incorrect. [1]

Because if they only have enough food to serve 20 guests for 6 days, the food should last shorter as there are 10 more guests. (less than 6 days)

(ii) Work out the correct answer. [2]

20 guests for 6 days
÷2 → 10 guests for 12 days ×2
3× → 30 guests for 4 days ÷3

4 days

5. *(a)* Find the value of $\left(\frac{1}{5}\right)^{-3}$. [2]

$\frac{1}{\left(\frac{1}{5}\right)^3} = \frac{1}{\frac{1^3}{5^3}} = \frac{5^3}{1} = 125$

(b) Find the value of $256^{\frac{3}{4}}$. [2]

$\left(\sqrt[4]{256}\right)^3 = 4^3 = 64$

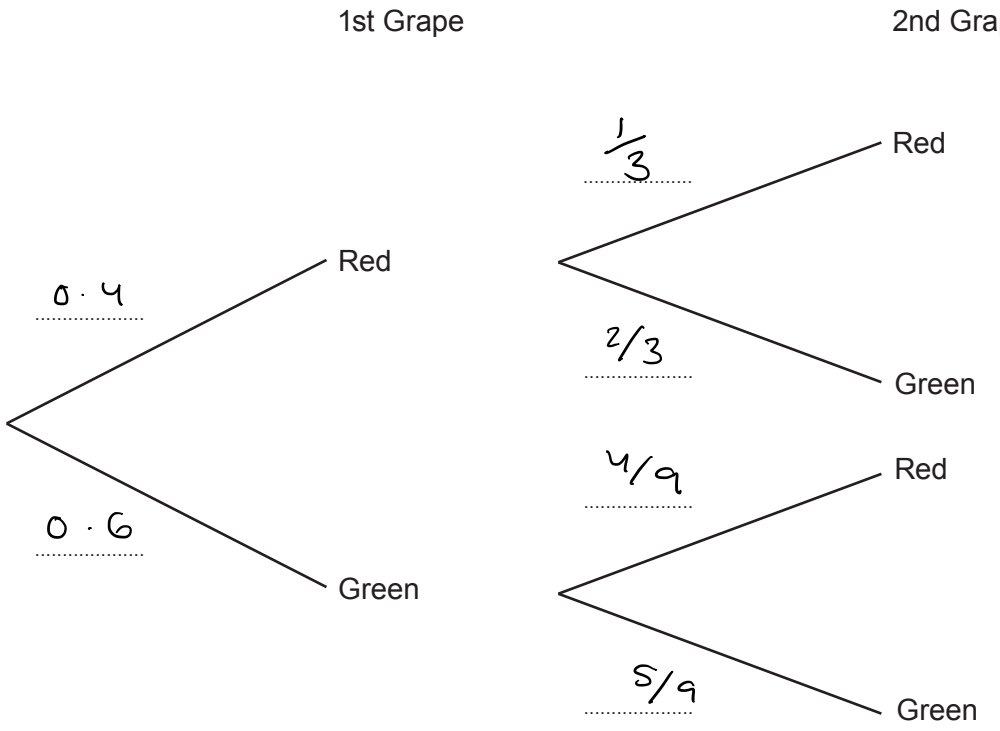
(c) **Estimate** the value of $50^{\frac{1}{2}}$. [1]

$\sqrt{49} = 7$, $\sqrt{64} = 8$

$\sqrt{50} \approx 7.1$

6. Vera has a pot containing 4 red grapes and 6 green grapes.
She takes a grape at random and eats it.
She then takes another grape at random and eats it.

(a) Complete the probability tree to show this information. [3]



(b) Work out the probability that the second grape Vera eats is green. [3]

$\left(0 \cdot 4 \times \frac{2}{3}\right) + \left(0 \cdot 6 \times \frac{5}{9}\right)$

$= \frac{4}{15} + \frac{1}{3}$

$= \frac{3}{5} = 0 \cdot 6$

7. *(a)* A 5-course banquet has 3 options for each course.
The number of possible 5-course meals is m.

Find the value of m. [2]

$3^5 \longrightarrow 3^3 = 27 \quad \therefore 3^4 = 27 \times 3 = 81$

$3^5 = 81 \times 3 = 243$

$m =$ 243

(b) The caterer for the banquet decides to change the menu so that there are only 2 options for the first course. The options for the other courses remain the same.

The number of possible 5-course meals is now pm.

Find the value of p. [2]

$3^4 \rightarrow 81 \times 2 : 3 \times 81$

$162 : 243$

excluding first course

$p \times 243 = 162$

$p = \frac{2}{3}$

$p =$ 2/3

8. *(a)* Write $\sqrt{44}+\sqrt{275}$ in the form $k\sqrt{11}$, where k is an integer. [2]

$\sqrt{44} + \sqrt{275}$

$\sqrt{4 \times 11} + \sqrt{25 \times 11}$

$2\sqrt{11} + 5\sqrt{11}$

$= 7\sqrt{11}, \quad k = 7$

(b) Show that $\dfrac{(\sqrt{3}-1)^2}{\sqrt{3}}$ can be written as $c\sqrt{3}+d$, where c and d are values to be found. [3]

$\dfrac{(\sqrt{3}-1)(\sqrt{3}-1)}{\sqrt{3}} = \dfrac{3-\sqrt{3}-\sqrt{3}+1}{\sqrt{3}}$

$= \dfrac{4-2\sqrt{3}}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}}$

$= \dfrac{4\sqrt{3}-6}{3}$

$= \dfrac{4\sqrt{3}}{3} - 2$

$c = \dfrac{4}{3}, \quad d = -2$

(c) $2\sqrt{x} - \sqrt{y} = 0$

Find a value for x and a value for y so that $\sqrt{x}$ and $\sqrt{y}$ are surds. [2]

$\sqrt{4x} = \sqrt{y}$

$4x = y$

If $y = 8$ $\quad\therefore\quad 2\sqrt{2} - \sqrt{8} = 0$

$x = 2$ $\quad\quad 2\sqrt{2} = 2\sqrt{2}$

$x =$ 2 $\quad y =$ 8