## TKAM

## Knowledge Organisers

Year 11

## Year 11 Term1Maths Knowledge Organiser [F unit 18 - Fractions, Indices\&Standard Form]

\section*{| CORE | GOOD TO KNOW... TKAK |
| :---: | :---: | :---: |}

Mixed Number - A number consisting of a whole number and a proper fraction.
Improper Fraction - A fraction whose numerator is larger than the denominator.

## Mixed Numbers Calculations

When multiplying or dividing mixed numbers change to an improper (top heavy) fraction first

## Indices

$2 \times 2 \times 2 \times 2$ can be written $2^{4}$

- When multiplying powers add the powers e.g. $6^{4} \times 6^{7}=6^{11}$ OR a $^{3} \times a^{5}=a^{8}$
- When dividing powers subtract the powers

$$
\text { e.g. } 6^{8} \div 6^{5}=6^{3} \text { OR } a^{9} \div a^{5}=a^{4}
$$

- When in brackets multiply the powers

$$
\text { e.g. }\left(8^{4}\right)^{3}=8^{12} O R\left(x^{5}\right)^{2}=x^{10}
$$

- Any number to the power of zero is I
- The reciprocal of any number is I divided by the
number eq: the reciprocal of 3 is $1 / 3$
- The reciprocal of a number is found by raising the number to the power of -I
- To find a negative power, find the reciprocal and raise to the positive power

Standard Form -is used to write very large of very small numbers

$$
a \times 10^{n}
$$

Where $\mathrm{I} \leq \mathrm{a}<10$ and n is an integer.

## Laws of indices

$$
\begin{aligned}
a^{m} \times a^{n} & =a^{m+n} \\
a^{m} \div a^{n} & =a^{m-n} \\
\left(a^{m}\right)^{n} & =a^{m \times n}
\end{aligned}
$$

$$
\begin{aligned}
& 10^{3}=1000 \\
& 10^{2}=\quad 100 \\
& 10^{1}=\quad 10 \\
& 10^{0}=\quad 1 \\
& 10^{-1}=\quad 0.1 \\
& 10^{-2}=\quad 0.01 \\
& 10^{-3}=
\end{aligned} 0.001
$$

| Examples |
| :--- |
| Work out the value of $\left(6.4 \times 10^{7}\right) \times\left(2 \times 10^{-3}\right)$ |
| Give your answer in standard index form. |
| $=6.4 \times 2 \times 10^{7} \times 10^{-3}$ |
| Law of |

Write the following in standard index form:
32000000
0.00000574
$=3.2 \times 10000000$
$=5.74 \times 0.000001$
$=3.2 \times 10^{7}$
$=5.74 \times 10^{-6}$

Write the following as ordinary numbers:

$$
\begin{array}{ll}
8.35 \times 10^{-3} & 2.9 \times 10^{6} \\
=8.35 \times 0.001 & =2.9 \times 1000000 \\
=0.00835 & =2900000
\end{array}
$$

$$
{ }_{x}^{+} \stackrel{3}{4} \frac{3}{4}=\frac{(4 \times 2)+3}{4}=\frac{8+3}{4}=\frac{11}{4}
$$

Mixed Number

## Year 11 Term 1 Maths Knowledge Organiser [H unit 18 - Vectors and Geometric Proof]

CORE

Vector arithmetic:
Where $a$ is the vector $\binom{3}{4}, ~$

$$
2 a=\binom{6}{8} \quad 3 a=\binom{9}{12} \quad 5 a=\binom{15}{20}
$$

We can add vectors by adding the two $\times$ components and adding the two $y$ components together.

$$
\begin{aligned}
& a=\binom{3}{4} \quad b=\binom{2}{7} \\
& a+b=\binom{3+2}{4+7} \quad=\binom{5}{11}
\end{aligned}
$$



## GOOD TO KNOW...

Vectors can be represented as:
Straight Lines


Column Vectors


## $\triangle B C D E F$ is a regular hexagon with centre $O$.


$\overrightarrow{O B}=b$
(a) Find, in terms of a , the vector $\overrightarrow{A D}$
(b) Find, in terms of a and b, the vector $\overrightarrow{A B}$
(a) Write down as a column vector $\overrightarrow{A B}$

$$
\binom{4}{-1}-\binom{3}{2}
$$

$C$ is the point $(5,-2)$ and $D$ is the point $(2,1)$.
(b) Write down as a column vector $\overline{C D}$
$\binom{2}{1}-\binom{5}{-2}$

## Year 11 Term 1 Maths Knowledge Organiser[F unit 19 - Congruence, similarity and vectors]

| CORE | GOOD TO KNOW... | HOW TO.... TKAT |
| :---: | :---: | :---: |
| Vector arithmetic: <br> Where a is the vector $\quad\binom{3}{4}$ | Vectors can be represented as: | In the figure, given that the two triangles are similar, what is the scale factor that nould take you from the larger, triangle to the |
| $2 a=\binom{6}{8} \quad 3 a=\binom{9}{12} \quad 5 a=\binom{15}{20}$ | Straight Lines Direction | Smaller triangle? <br> - Corresponding angles are congruent |
| We can add vectors by adding the two x components and adding the two $y$ components together. | $1\binom{3}{1} \xrightarrow[3]{1}$ | II in proportion $5.5$ |
| $\mathbf{a}=\binom{3}{4} \quad \mathbf{b}=\binom{2}{7}$ |  | $11 \times \frac{1}{2}=\frac{11}{2}$ |
| $\mathbf{a}+\mathbf{b}=\binom{3+2}{4+7} \quad=\binom{5}{11}$ <br> Keywords |  | scaule factor $=$ original length $=5.5$ $\text { scale factor }=\frac{6}{12}=\frac{1}{2}$ $\frac{1}{2}$ |

Similarity - Two shapes are Similar when one can become the other after an enlargement, reflection, translation or rotation.

Enlargement - A type of transformation where we change the size of the original shape to make it bigger or smaller.

Scale Factor - The ratio between the scale of a given original object and a new object, which is its representation but of a different size (bigger or smaller).

Congruent - Two shapes are congruent if they have the same shape and size, or when one shape can be rotated or reflected to fit exactly on the other.

Vector - A vector is a quantity that has both a magnitude and a direction

## Year 11 Term 2 Maths Knowledge Organiser

[H unit 19 - Proportions and graphs]
CORE GOOD TO KNOW... HOW TO.... TKAT

## Direct proportion means that one quantity increases at

 the same rate as the other.If one banana costs 20 p , three bananas will cost 60 p etc. The amount of bananas increase by $x 3$ and the cost also increases by $x 3$ so both are in direct proportion.

A quantity can be proportional to the square, cube or square root of another quantity.

Inverse proportion means that when one quantity increases, the other decreases.

- If it takes 2 decorators 6 hours to paint a room, it will take 4 decorators 3 hours to paint the same room. The number of decorators has doubled and the amount of time has halved.
$y$ is directly proportional to $x$.
When $y=20, x=8$

```
a Express \(y\) in terms of \(x\).
```

b Find $x$ when $y=35$.
$35=2.5 \times x$
$y$ is inversely proportional to $x$.
When $y=2, x=3$
a Write a formula for $y$ in terms of $x$.
b Calculate the value of $y$ when $x=8$
a $y \propto \frac{1}{x} 50 y=\frac{k}{x}$


The sketch shows part of the graph $y=a b^{x}$
The points with coordinates $(0,3)$ and $(2,12)$ lie on the graph. Work out the values of $a$ and $b$.


This sketch shows part of the graph with equation $y=p q^{*}$ where $p$ and $q$ are constants.


The points with coordinates $(0,8),(1,18)$ and $(1.5, k)$ lie on the graph.

$x=14$

Substitute $y=35$ into $y=2.5 x$.

## Year 11 Term Maths Knowledge Organiser

[F unit 20 - More algebra]
A linear graph is a straight line

$\quad$| Quadratic, cubic and reciprocal graphs are curved |
| :--- |
| A quadratic equation contains a term in $\mathrm{x}^{2}$ but no |
| higher power. It can also have $x$ and number terms. |
| A cubic contains a term in $x^{3}$ but no higher power. |
| It can also have terms in $x^{2}$ and $x$ and number |
| terms. |
| both variables (letters) | both variables (letters)

- To solve a simultaneous equation graphically, look at the point where both straight lines intersect (cross) and write down that coordinate.
- To solve a simultaneous equation by the elimination method, add or subtract the equations to eliminate either the x or y terms.

A term is a number, letter, or a number and a letter multiplied together i.e. $x, 3 \mathrm{a}, 7 \mathrm{y}^{2}$ are all terms
An expression contains letter and/ or number terms but no equal sign.
An equation has an equals sign, letter terms and numbers. You can solve it to find the value of the letter.
An identity is true for all values of letters
A formula has an equals sign and letters to represent different quantities. The letters are variables as their values can vary.

## HOW TO....

## a. Make a the subject of the formula $v^{2}=u^{2}+2 a s$

b. Make. $x$ the subject of the formula $y=\frac{a x+b}{c}$

$$
a v^{2}=u^{2}+2 a s
$$

$$
\text { b } y=\frac{a x+b}{c}
$$



## Simultaneous Equations

By elimination method

1. Two linear equations

Example
Solve (i) $2 x+y=5$
$\qquad$ Eliminate $y$ by adding the equations
$x=2$
$x-y=1 \quad$ Putting value back into $2^{\text {nd }}$ equation

## Year 11 Term 3 Maths Knowledge Organiser [Foundation Revision]

## CORE GOOD TO KNOW... HOW TO.... TKAT

Perimeter
Calculated by adding up the length of each of the sides.

## Circumference of circle - Trd

## Area

- Square/Rectangle $=$ length $\times$ width
- Triangle $=1 / 2 \times$ base $\times$ height
- Trapezium $=1 / 2 \times a+b \times$ height
- Circle - $\pi r^{2}$
- Measure in squared units, e.g. $\mathrm{cm}^{2}$


## Volume

Cube/cuboid $=$ length $\times$ width $\times$ height

- Prism $=$ area of cross section (front face) $\times$ length
- Cylinder $=$ area of circle (front face) $\times$ length
- Measure in cubic units, e.g. $\mathrm{cm}^{3}$.

Right Angle - $90^{\circ}$ Angle
Angles on a straight line $=180^{\circ}$
Angles around a point $=360^{\circ}$
Angles in a triangle $=180^{\circ}$
Exterior angles in a polygon $=360^{\circ}$

$$
1 \mathrm{~m}
$$

100 cm


1 metre squared $=10,000$ centimetre squared

Expand $3(x+4)$ Multiply what's inside by 3 $3 x+12$

Factorise $5 x-20$ Find HCF and put in brackets $5(x+4)$

Solve $3 x+4=40$ Use inverse operations to find value of x

$$
\begin{gathered}
-4 \quad-4 \\
3 x=36 \\
\div 3 \quad \div 3 \\
x=12
\end{gathered}
$$

## Percent Change

Percent Change $=\frac{\text { New Value }- \text { Old Value }}{\text { Old Value }} \times 100 \%$
f the result is positive, it is an increase. If the result is negative, it is a decrease.

$$
\begin{aligned}
& \text { Increase } £ 50 \text { by } 60 \% . \\
& \begin{aligned}
& 160 \% \times £ 50=1.6 \times £ 50 \\
&=£ 80 \\
& \text { Increase } £ 86 \text { by } 7 \% . \\
& 107 \% \times £ 86=1.07 \times £ 86 \\
&=£ 92.02
\end{aligned} \\
& \begin{aligned}
&
\end{aligned} \\
& \text { ( } 80
\end{aligned}
$$

## Year 11 Term 3 Maths Knowledge Organiser

[Higher Revision]


