

# Homework <br> <br> Booklet 

 <br> <br> Booklet}

## Unit 1 Expressions and Formulae

1. Simplify
(a) $\sqrt{147}-5 \sqrt{3}$
(b) $\sqrt{2}(\sqrt{3}+\sqrt{2})-\sqrt{6}$
2. Express

$$
2 \sqrt{5}+\sqrt{20}-\sqrt{45}
$$

as a surd in its simplest form.
3. Express with a rational denominator

$$
\frac{5}{2 \sqrt{3}}
$$

4. Express as a fraction with a rational denominator

$$
\frac{5}{4-\sqrt{3}}
$$

5. In the rectangle $A B C D$, the diagonal $A C$ is 8 cm and the height $B C$ is 4 cm .

(a) Calculate the length of the rectangle, giving your answer as a surd in its simplest form.
(b) Calculate the area of triangle $A B C$.
6. Find the length of the diagonal, $A B$, of this rectangle leaving your answer as a surd in its simplest form.

7. Simplify $\frac{m^{5}}{m^{3}}$
8. Simplify the expression below, giving your answer with a positive power.

$$
m^{5} \times m^{-8}
$$

3. Express

$$
p^{3}\left(p^{2}-p^{-3}\right) \quad \text { in its simplest form. }
$$

4. Simplify

$$
\frac{3 a^{2} \times 2 a}{a^{2}}
$$

5. Express in its simplest form

$$
\frac{y^{4} \times y}{y^{-2}}
$$

6. Evaluate $16^{\frac{3}{4}}$
7. Simplify, expressing your answer with positive indices.

$$
\left(x^{2} y^{4}\right) \div\left(x^{-3} y^{6}\right)
$$

8. Simplify

$$
k^{8} \times\left(k^{2}\right)^{-3}
$$

9. Express $a^{\frac{2}{3}}\left(a^{\frac{2}{3}}-a^{-\frac{2}{3}}\right)$ in its simplest form.
10. Express $a^{\frac{1}{2}}\left(a+\frac{1}{a}\right) \quad$ in its simplest form.
11. Write the numbers in each of these sentences in standard form.
(a) The mass of the moon is about 79250000000000000000000 kg
(b) The relative density of hydrogen is 0.0000899
12. Write the numbers in each of these sentences in full.
(a) The number of seconds in a decade is about $3.2 \times 10^{8}$
(b) The size of a molecule of water is roughly $1 \times 10^{-3}$
13. Calculate each of the following, giving your answers in standard form.
(a) $\left(4.2 \times 10^{10}\right) \times\left(3 \times 10^{-2}\right)$
(b) $\frac{4 \cdot 2 \times 10^{5}}{8 \times 10^{-1}}$
(c) $\frac{\left(3 \cdot 2 \times 10^{2}\right) \times\left(4 \cdot 5 \times 10^{-3}\right)}{3 \times 10^{-6}}$
14. The Earth is 93 million miles from the sun, which is one astronomical unit (AU).

The distance from the sun to Jupiter is 5.2 AU .
Calculate the distance in miles from the sun to Jupiter and give your answer in standard form.
5. A company's profit for the year was $£ 1.2 \times 10^{8}$.

Calculate the profit made per day, giving your answer to the nearest $£$.
6. Use your calculator to find the following. Answer correct to 3 significant figures
(a) $8.4 \div(9.6-5.7)$
(b) $20 \times(2.1 \div 5.9)$
(c) $\frac{58}{(1 \cdot 2 \times 14)}$
(d) $2500 \times 1.045^{3}$

Multiply out the brackets and simplify in each question.

1. (a) $3(x+7)+2 x$
(b) $16 y-5(2 y+3)$
(c) $7(s-2)-13$
2. (a) $x\left(x^{3}+2\right)$
(b) $3 m(8-m)$
(c) $\quad 2 y^{2}(w-5 y)$
3. (a) $9(a+5)+7(2 a+7)$
(b) $7(y-8)-5(3 y-6)$
4. 

(a) $\quad(x+4)(x+7)$
(b) $(y-9)(y-3)$
(c) $\quad(s+12)(s-2)$
(d) $(2 a+5)(a+9)$
(e) $(3 w-8)(2 w+1)$
(f) $(4 x-3)^{2}$
5. (a) $(x+1)\left(x^{2}+1\right)$
(b) $(x-2)\left(2 x^{2}-3 x-2\right)$

## Factorise each expression in the following:

1. (a) $y^{2}+5 y$
(b) $4 x^{2}-49$
(c) $5 s^{2}-20$
2. (a) $x^{2}+10 x+25$
(b) $x^{2}-10 x-24$
(c) $k^{2}+5 k-6$
3. (a) $12 a^{2}+7 a-12$
(b) $7 w^{2}-2 w-9$
(c) $4 x^{2}-11 x+6$
4. (a) $12 x^{2}+16 x+4$
(b) $3 m^{2}-6 m-9$
(c) $3-3 x-36 x^{2}$
5. (a) $x^{5}-81 x$
(b) $a^{2}+3 a b+2 b^{2}$

## Completing the Square

1. Write each of the following quadratic expressions in the form $a(x+b)^{2}+c$ :
(a) $x^{2}+6 x-3$
(b) $x^{2}-5 x+1$
(c) $4+8 x-x^{2}$
(d) $1-6 x-x^{2}$
2. Show that the function $f(x)=x^{2}-16 x+7$ can be written in the form $f(x)=(x+p)^{2}+q$ and write down the values of $p$ and $q$.

Hence state the minimum value of the function and the corresponding value of $x$.

## Algebraic Fractions

1. Simplify:
(a) $\frac{19}{57}$
(b) $\frac{w^{3}}{w}$
(c) $\frac{5 x}{10}$
(d) $\frac{12 x^{2}}{36 x}$
2. Simplify:
(a) $\frac{(2 x+1)}{(2 x+1)(2 x-1)}$
(b) $\frac{x^{2}+5 x+6}{(x+3)}$
(c) $\frac{x^{2}-x-6}{x^{2}+4 x+4}$
3. Simplify:
(a) $\frac{m}{5}+\frac{m}{4}$
(b) $\frac{m+4}{2}+\frac{m-3}{5}$
(c) $\frac{4}{x}-\frac{1}{x+3}$
(d) $\frac{x+1}{x+2}+\frac{x-2}{x+1}$
4. Express each of the following in its simplest form.
(a) $\frac{7}{3 k} \times \frac{9 k}{21}$
(b) $\frac{3 x}{5} \times \frac{2}{9 x^{2}}$
(c) $\frac{1}{a^{2}} \div \frac{2}{a}$
(d) $\frac{2 x}{y} \div \frac{4 x^{2}}{3 y}$
5. The line CD passes through the points $(0,5)$ and $(6,0)$


Calculate the gradient of CD.
2. A line passes through the points $A(-2,-4)$ and $B(8,1)$.

Find the gradient of the line $A B$.
3. Prove that the points $A(0,-2), B(-4,4)$ and $C(6,-11)$ all lie on the same straight line.
4. The points $\mathrm{S}(k, 3), \mathrm{T}(10,2)$ and $\mathrm{U}(-2,5)$ are collinear. Find the value of $k$.
5. Calculate the gradient of a line which is parallel to the line passing through $F(3,-7)$ and $G(-8,2)$.
6. The line which passes through $(-4,1)$ and $(-7,-11)$ is parallel to the line through $(2, y)$ and $(-3,-3)$. Find the value of $y$.
7. What is the gradient of the line perpendicular to the line with equation $y=3 x-5$ ?
8. The line which passes through $(-2,2)$ and $(-6,-4)$ is perpendicular to the line through $(4, b)$ and $(-2,-2)$. Find the value of $b$.

## Give your answers correct to 3 significant figures where necessary.

1. (a) Find the length of the minor arc $A B$ in this circle.
(b) Calculate the area if the minor sector $A O B$.

2. 


(a) Find the length of the major arc PQ in this circle.
(b) Calculate the area of the major sector POQ.
3. The length of $\operatorname{arc} C D$ is 8.8 cm . Calculate the circumference of the circle.

4. The area of sector $O P Q$ is $100 \mathrm{~cm}^{2}$. Calculate the size of angle, $x^{0}$, to the nearest degree.

5. Ornamental paving slabs are in the shape of part of a sector of a circle.

Calculate the area of the slab shown.


## Volume of a Sphere, Cone and Pyramid

## Give your answers correct to 3 significant figures where necessary.

1. 



16 cm

A cone has a base diameter of 16 cm and a height of 17 cm .
Calculate the volume of the cone, giving your answer correct to 3 sig figs.

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

2. A lead sinker is in the shape of a cone with a hemispherical base.

The total height of the sinker is 12 cm and the diameter of the base is 10 cm
Calculate the volume of lead required to make the sinker.

$$
\text { [Volume of sphere }=\frac{4}{3} \pi r^{3} \text { ] }
$$


3. (a) Calculate the volume of the largest sphere which will fit inside a cube of side 15 cm .
(b) Calculate the volume of wasted space between the two. [Answer to nearest $\mathrm{cm}^{3}$ ]
4. A pyramid has a square base of side 6 cm and a vertical height of 9 cm .

Calculate the volume of the pyramid correct to 2 significant figures.

