A Level Mathematics

A transition guide for Year 11 students

OCR

Oxford Cambridge and RSA

GCSE to A-Level Mathematics Transition material

Mathematics that you should be very familiar with from GCSE; this is expected knowledge at A-Level

Indices

$a^0 = 1$

$a^{-1} = \frac{1}{a}$

$a^{\frac{1}{2}} = \sqrt{a}$

$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

Laws of indices

$a^m \times a^n = a^{m+n}$

$\frac{a^m}{a^n} = a^m \div a^n = a^{m-n}$

$\left(a^m\right)^n = a^{mn}$

Surds

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

Quadratic Equations

For $ax^2 + bx + c = 0$, the roots of this are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ this is the quadratic formula

This work is expected that you can simply complete it. If you find that you cannot remember what to do, or you have not seen it before then use your summer time to prepare for you're A-Level in mathematics.

Please get in contact with the school if you feel that you need additional guidance or support completing this work.

You should complete this work on lined A4 paper. I would advise you not to get spiral bound paper, as a file and a folder are much more suitable.

Completion of work is required and you should be handing it to your teachers during the second full week of term.

1. Simplify the following expressions

a) $x^3+2x^2-5x+7x^2+3x-4$ b) $x^4-3x^3-2x^2+2x^3-6x^2-4x$

c) $2ab-a^2+4b^2-2ab$ d) $3x^2+6xy-12x-2xy+6y^2+8y$

2. Evaluate (i.e. work out)

a) 2^{-3} b) $25^{\frac{1}{2}}$ c) $\left(\frac{1}{3}\right)^{-2}$ d) $\left(\frac{64}{27}\right)^{-\frac{4}{3}}$ e) $\left(6\frac{1}{4}\right)^{\frac{1}{2}}$ f) $49^{\frac{3}{2}}$

3. Simplify the following expressions

a) $7^3\times7^4$ b) $\frac{3^4\times3^6}{3^5}$ c) $\left(4^3\right)^8$ d) $\frac{2^5\times2^9}{\left(2^3\right)^5}$ e) $4x^3\times2x^5$

f) $\left(3a\right)^3$ g) $\left(-2p^2q^3\right)^4$ h) $\frac{2x^2y^3z\times6x^4yz^3}{\left(9xy^4z^2\right)^2}$

4. Rearrange these formulae to make the letter in brackets the subject of each formula

a) $v=u+at \quad (a)$ b) $s=\frac{1}{2}(u+v)t \quad (v)$

c) $A=2\pi r^2+2\pi rh \quad (h)$ d) $y=\frac{2x+1}{x-1} \quad (x)$

5. Expand and completely simplify each expression

a) $6(2x+3)$ b) $-2x(x-5)$ c) $2xy^2(3x-5y)$ d) $5y(4-3x)-2x(3-2y)$

e) $(x+7)(x-7)$ f) $(2x-3)(x+5)$ g) $(2x+y)(2-3y)$ h) $(3a+4b)(5b-2a)$

6. Completely factorise these expressions

a) $7x+21$ b) $3ab-12b$ c) $7x^2y+21x^3y^2$ d) $30xy+6x^2-15x$

7. Completely factorise these expressions

a) x^2+x+20 b) $x^2-12x+35$

c) $y^2-2y-63$ d) $a^2-6a-16$

e) $2x^2+x+1$ f) $2x^2+5xy-3y^2$

g) x^2-9 h) $9x^2-25y^2$

i) $16x^4-36y^6$ j) x^3+22x^2-75x

8. Solve these quadratic equations by factorizing (do not use a calculator)

a) $x^2+15x+54=0$ b) $t^2-3t-40=0$ c) $3x^2-x-14=0$

d) $7a-6a^2+20=0$ e) $9x^2+12x+4=0$ f) $x+1=\dfrac{6}{x}$

9. Solve these equations be the method stated.

Use the quadratic formula

a) $x^2+12x+20=0$ b) $t^2+9t+4=0$ c) $3x^2-7x=1$

Use the method of completing the square

d) $x^2+8x-4=0$ e) $r^2-12r-12=0$ f) $2p^2+12p-6=0$

10. Fully simplify the following, expressing them as $a\sqrt{b}$

a) $\sqrt{44}$ b) $\sqrt{320}$ c) $\sqrt{75}$ d) $\sqrt{304}$

e) $\dfrac{\sqrt{32}}{\sqrt{25}}$ f) $\dfrac{\sqrt{27}}{\sqrt{16}}$ g) $\sqrt{\dfrac{50}{9}}$ f) $\sqrt{\dfrac{496}{304}}$

11. Fully simplify these expressions

a) $4\sqrt{7}-3\sqrt{7}+6\sqrt{7}$ b) $4\sqrt{2}-\sqrt{50}+98$ c) $\sqrt{3}\left(7+2\sqrt{3}\right)$

d) $\left(\sqrt{7}-\sqrt{3}\right)\left(\sqrt{7}+\sqrt{3}\right)$ e) $\dfrac{3}{\sqrt{5}}$ f) $\dfrac{6}{\sqrt{3}-1}$

12. Solve these simultaneous equations

a) $\begin{aligned}3x+2y&=13\\2x-y&=2\end{aligned}$ b) $\begin{aligned}2x+3y&=10\\5x+2y&=3\end{aligned}$ c) $\begin{aligned}3x+y&=7\\2x-3y&=23\end{aligned}$ d) $\begin{aligned}8x+4y&=5\\6x-8y&=1\end{aligned}$

13. Solve these simultaneous equations

a) $\begin{aligned}y&=x^2-x-6\\y&=x+2\end{aligned}$ b) $\begin{aligned}y&=2x+3\\y(5-x)&=20\end{aligned}$ c) $\begin{aligned}(x-3)^2+y^2&=25\\3y+x&=18\end{aligned}$

This is an example of the type of test that you will be required to do when you start you're A-Level in mathematics. This is both easier and longer than the test you are going to be doing in September.

1 Simplify these expressions.

a $\dfrac{x^3 \times x^4}{x^2}$ (1 mark)

b $\left(2x^3\right)^4$ (1 mark)

c $\dfrac{9x^{\frac{1}{2}}}{\left(27x^{-2}\right)^{\frac{2}{3}}}$ (3 marks)

2 Solve $2x^2 \times 4x^4 = 512$ (2 marks)

3 Find the value of x which satisfies the equation $x^{\frac{-4}{3}} = \dfrac{1}{256}$ (2 marks)

4 a Write 240 in the form $a\sqrt{b}$, where *a* and *b* are integers. (1 mark)

b Expand and simplify $\left(2-\sqrt{3}\right)\left(5+2\sqrt{3}\right)$. (2 marks)

c Simplify $\dfrac{2+\sqrt{5}}{3-\sqrt{5}}$ giving your answer in the form $a+b\sqrt{c}$, where a, b and *c* are rational numbers. (3 marks)

5 The area of a triangle is given as $\left(7+3\sqrt{3}\right)$ cm^2.

The base of the triangle is $\left(5-\sqrt{3}\right)$ cm, and the perpendicular height is $\left(p+q\sqrt{3}\right)$ cm. Find the values of p and q. (4 marks)

6 Expand and simplify these expressions.

a $3\left(x-2y\right)$ (1 mark)

b $\left(2x-3\right)\left(3x+5\right)$ (2 marks)

c $\left(x-2\right)^2\left(x+5\right)$ (3 marks)

7 Fully factorise these expressions.

a $2xy-4x$ (1 mark)

b x^2+2x-3 (1 mark)

8 Solve these equations.

a $3x-7=17$ (1 mark)

b $x^2-6x+5=0$ (2 marks)

c $2x^2-5x+1=0$ (2 marks)

9 Solve these pairs of simultaneous equations.

a $2x+y=7$ and $3x-y=8$ (3 marks)

b $y=3x-1$ and $3y=6x+1$ (3 marks)

c $2x-y=9$ and $x^2+y^2=17$ (4 marks)

10 Solve these inequalities.

a $7x-6\leq 8$ (1 mark)

b $3x+2\geq 7x-4$ (2 marks)

c $x^2+12x-28>0$ (2 marks)

11a The function f is defined as $f(x)=5x+2$

Find the value of $f(-4)$ (1 mark)

Find the value of t if $f(t)=27$ (1 mark)

11b The function g is defined as $g(x)=x^2-6x-5=0$

$g(x)$ has a turning point at A. Find the co-ordinates of A. (3 marks)

11c Determine the function defined by gf(x) in the form ax^2+bx+c (3 marks)