Year 12 Intro 1

Question 1

Skill involved: 194a: Use laws of indices for multiplying powers with algebraic bases.

Simplify

$d^5 \times d^7$

.....

(1 mark)

Question 2

Skill involved: 194d: Multiply algebraic terms with powers.

Simplify fully

$2x^2y^3 \times 4xy^2$

.....

(2 marks)

Question 3

Skill involved: 194e: Divide algebraic terms with powers.

Simplify fully

$\frac{20x^2y^6}{4x^2y^2}$

.....

(2 marks)

Question 4

Skill involved: 194e: Divide algebraic terms with powers.

Simplify fully

$12a^4b^5 \div 2a^2b$

.....

(2 marks)

Question 5

Skill involved: 194h: Simplify an expression using multiple index laws with a single algebraic variable.

Simplify fully

$\frac{a^{11}}{a^2 \times a^5}$

.....

(2 marks)

Question 6

Skill involved: 194g: Use laws of indices for raising a power to a power with an algebraic base.

Simplify.

$\left(b^5\right)^3$

.....

(1 mark)

Question 7

Skill involved: 194g: Use laws of indices for raising a power to a power with an algebraic base.

Simplify

$(5y^3)^2$

.....

(2 marks)

Question 8

Skill involved: 194h: Simplify an expression using multiple index laws with a single algebraic variable.

Simplify $\frac{\left(5ab^4\right)^3}{a^2}$.

.....

(3 marks)

Question 9

Skill involved: 194a: Use laws of indices for multiplying powers with algebraic bases.

Write $m^{\frac{1}{2}} \times m^{\frac{3}{2}}$ as a single power of m.

.....

(1 mark)

Question 10

Skill involved: 252j: Expand and simplify the difference of two sets of single brackets with integer multipliers.

Expand and simplify $4(2d + 3) - 2(3d - 5)$

.....

(2 marks)

Question 11

Skill involved: 194e: Divide algebraic terms with powers.

Simplify the expression

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

.....

Question 12

Skill involved: 364d: Factorise quadratic expressions given in the form $\mathbf{ax^2 - bx - c}$ with $\mathbf{a > 1}$

Factorise

$4x^2 - 7x - 2$

.....

(2 marks)

Question 13

Skill involved: 364d: Factorise quadratic expressions given in the form $\mathbf{ax^2 - bx - c}$ with $\mathbf{a > 1}$

Factorise

$6x^2 - 23x - 4$

.....

(2 marks)

Question 14

Skill involved: 387e: Simplify algebraic fractions where factorisation of a simple quadratic on both the numerator and denominator is required.

Simplify

$\frac{x^2-4x}{x^2+x-20}$

.....

(3 marks)

Question 15

Skill involved: 387f: Simplify algebraic fractions where factorisation of a non-monic quadratic expression on the numerator or denominator is required.

Simplify

$\frac{3x^2-x-10}{x^2-4}$

.....

(3 marks)

Question 16

Skill involved: 387f: Simplify algebraic fractions where factorisation of a non-monic quadratic expression on the numerator or denominator is required.

Factorise, and hence simplify:

$\frac{4x^2-25}{2x^2-x-10}$

.....

(3 marks)

Question 17

Skill involved: 260a: Change the subject of a linear formula involving multiplication using brackets.

The area of a trapezium is given by the formula

$A = \frac{1}{2}h(x+y)$

Make x the subject of the formula.

$x =$ .....

(3 marks)

Question 18

Skill involved: 260d: Change the subject of a formula where the subject is squared and with additional steps.

Change the subject of the following formula to v.

$p = \frac{mv^2}{2}$

.....

(3 marks)

Question 19

Skill involved: 260i: Change the subject of a formula with roots and additional steps.

Change the subject of the formula $y = g\sqrt{x} + h$ to x.

$x =$ .....

(3 marks)

Question 20

Skill involved: 391c: Change the subject of a formula where the subject appears on both sides.

Make t the subject of the formula

$2(d - t) = 4t + 7$

$t =$ .....

(3 marks)

Question 21

Skill involved: 391e: Change the subject of a formula where the subject appears twice with a square root.

Make y the subject of the formula

$x = \sqrt{\frac{y+1}{y-2}}$

$y =$ .....

(5 marks)

Question 22

Skill involved: 391d: Change the subject of a formula where the subject appears twice on a fraction.

Make x the subject of

$P = \frac{100(y-x)}{x}$

$x =$ .....

(4 marks)

Question 23

Skill involved: 391d: Change the subject of a formula where the subject appears twice on a fraction.

Make d the subject of

$c = \frac{8(c-d)}{d}$

$d =$ .....

Mark scheme

Question 1

d^{12}

d^{12}	1	B1	

Question 2

$8x^3y^5$

9b	$8x^3y^5$	B2	B1 If all parts correct but × or one + included B1 for 2 correct (× may be included but + may not) B1 if wrong further work after correct answer seen
	Additional Guidance		
	$8x^3y^6$	B1	
	$6x^3y^5$	B1	
	$8x^2y^5$	B1	
	$8 \times x^3 \times y^5$	B1	
	$8 \times x^3 + y^5$	B1	
	$8x^3y^5 = 8xy^8$	B1	
	$8 \times x^3 \times y^6$	B1	
	$8 + x^3 + y^5$	B0	

Question 3

$5y^4$

$5y^4$	2	B2	B1 for fully simplifying terms in x or terms in y

Question 4

$6a^2b^4$

9c	$6a^2b^4$	B2	B1 If all parts correct but × or one + included B1 for 2 correct (× may be included but + may not) B1 if wrong further work after correct answer seen
	Additional Guidance		
	$10a^2b^4$		B1
	$6a^3b^4$		B1
	$6a^2b^5$		B1
	$6 \times a^2 \times b^4$		B1
	$6 \times a^2 + b^4$		B1
	$6a^2b^4 = (3ab^2)^2$		B1
	$10 \times a^2 \times b^4$		B1
	$6 + a^2 + b^4$		B0

Question 5

a^4

e.g. $\frac{a^{11}}{a^7}$ or $\frac{a^6}{a^2}$ or $\frac{a^9}{a^5}$ oe	a^4	2	M1 A1	For $\frac{a^{11}}{a^7}$ or any index law used correctly

Question 6

b^{15}

b^{15}	1	

Question 7

$25y^6$

$25y^6$	A1 A1

Question 8

$125ab^{12}$

(c) $125ab^{12}$	B3	Mark final answer B2 for any two elements of $125ab^{12}$ correct in their final answer e.g. 5^3ab^{12} or $\frac{125a^3b^{12}}{a^2}$ or B1 for any one element of $125ab^{12}$ correct in their final answer or for $\frac{5^3a^3b^{12}}{a^2}$ seen at some stage

Question 9

m^2

m^2	B1

Question 10

$2d + 22$

$8d + 12 - 6d + 10$	$2d + 22$	2	M1	3 out of 4 terms correct with signs correct or 4 terms correct ignoring signs
			A1	for $2d + 22$ **or** $2(d + 11)$

Question 11

a

1m	a

Question 12

$(4x + 1)(x - 2)$

$(4x+1)(x-2)$	2	M1 for $(4x \pm 1)(x \pm 2)$ A1 cao

Question 13

$(6x + 1)(x - 4)$

$(ax \pm c)(bx \pm d)$	M1	$ab = 6$, $cd = 4$ or -4 $6x(x - 4) + (1)(x - 4)$ $x(6x + 1) - 4(6x + 1)$
$(6x + 1)(x - 4)$	A1	Ignore any subsequent attempt to solve once the correct factorisation seen

Question 14

$\frac{x}{x+5}$

Ans: $\frac{x}{x+5}$ •[1] factorise numerator •[2] factorise denominator •[3] cancel brackets correctly	3	•[1] $x(x-4)$ •[2] $(x-4)(x+5)$ •[3] $\frac{x}{x+5}$

Question 15

$\frac{3x+5}{x+2}$ or $\frac{3x-5}{x-2}$

20(c)	$(ax+b)(cx+d)$ or $(x+2)(x-2)$	M1	where $ac = 3$ and $bd = -10$ or $ad + bc = -1$
	$(3x+5)(x-2)$	A1	
	$\frac{3x+5}{x+2}$	A1	Do not ignore fw
	Additional Guidance		
	$\frac{(3x-5)(x+2)}{(x+2)(x-2)}$ $= \frac{(3x-5)}{(x-2)}$		M1 A0 A0

Question 16

$\frac{2x+5}{x+2}$

(a) The expression given is a "difference of two squares".

Factorise as follows:

$4x^2 - 25$

$= (2x)^2 - (5)^2$

$= (2x+5)(2x-5)$

(b) Note that the **numerator** is the same expression given in part (a), which you have **already factorised**. The **denominator** is a quadratic expression, which can be factorised using the 'grouping' method:

$2x^2 - x - 10$

$= 2x^2 + 4x - 5x - 10$

$= 2x(x+2) - 5(x+2)$

$= (x+2)(2x-5)$

Replace each expression in the algebraic fraction with their **factorised** form:

$\frac{4x^2-25}{2x^2-x-10}$

$= \frac{(2x+5)(2x-5)}{(x+2)(2x-5)}$

Note that $(2x-5)$ is a **common factor** and can be 'cancelled', leaving:

$= \frac{2x+5}{x+2}$

Question 17

$\frac{2A}{h} - y$ or $\frac{2A-hy}{h}$

Method 1	**Method 1**
•1 multiply by 2	•1 $2A = h(x+y)$
•2 divide by h	•2 $\frac{2A}{h} = x+y$
•3 subtract y	•3 $x = \frac{2A}{h} - y$
Method 2	**Method 2**
•1 multiply by 2	•1 $2A = h(x+y)$
•2 expand bracket **and** subtract hy	•2 $2A - hy = hx$
•3 divide by h	•3 $x = \frac{2A-hy}{h}$

Question 18

$v = \sqrt{\frac{2p}{m}}$ or $\sqrt{\frac{2p}{m}}$

$p = \frac{mv^2}{2}$

$\Rightarrow 2p = mv^2$

$\Rightarrow \frac{2p}{m} = v^2$

$\Rightarrow \sqrt{\frac{2p}{m}} = v$

$\Rightarrow v = \sqrt{\frac{2p}{m}}$

Ans: $v = \sqrt{\frac{2p}{m}}$ •1 multiply by 2 •2 divide by m •3 square root	3	•1 $mv^2 = 2p$ •2 $v^2 = \frac{2p}{m}$ •3 $v = \sqrt{\frac{2p}{m}}$

Question 19

$\left(\frac{y-h}{g}\right)^2$

•1 subtract h •2 divide by g •3 square	•1 $y - h = g\sqrt{x}$ •2 $\sqrt{x} = \frac{y-h}{g}$ •3 $x = \left(\frac{y-h}{g}\right)^2$

Question 20

$\frac{2d-7}{6}$

$2d - 2t = 4t + 7$ $2d - 7 = 4t + 2t$ $2d - 7 = 6t$ $\frac{2d-7}{6}$	$\frac{2d-7}{6}$	3	B1 for $2d - 2t$ or $2t + \frac{7}{2}$ oe M1 for rearranging 4 terms correctly to isolate terms in t e.g. '$2d$' $- 7 = 4t +$ '$2t$' or $2d - 7 = 6t$ or $-6t = 7 - 2d$ seen A1 for $\frac{2d-7}{6}$ oe

Question 21

$\frac{2x^2+1}{x^2-1}$

$x^2 = \frac{y+1}{y-2}$	M1	Square
$x^2(y-2) = y+1$	M1	Multiply
$x^2y - y = 2x^2 + 1$	M1	oe Expand and rearrange
$y(x^2-1) = 2x^2+1$	M1	Factorise
$y = \frac{2x^2+1}{x^2-1}$	A1	Divide

Question 22

$\frac{100y}{P+100}$ or $\frac{100y}{p+100}$

$xP = 100(y - x)$ or $P = \frac{100y-100x}{x}$ $xP = 100y - 100x$ $x(P + 100) = 100y$	$\frac{100y}{P+100}$ oe	4	M1 M1 M1 A1	$P = 100y/x - 100x/x$ $P + 100 = 100y/x$ $x(P+100) = 100y$

Question 23

$\frac{8c}{c+8}$