Year 11 to Year 12 Transition Paper

Algebraic Expressions

Mark Scheme

Question	Scheme	Marks
1	for expanding bracket to obtain 4 terms with all 4 correct without considering signs or for 3 terms out of 4 correct with correct signs	M1
	$12x^2 - 5x - 3$	A1
		(2 marks)

Question	Scheme	Marks
2(a)	For expanding bracket to obtain 4 terms with all 4 correct without considering signs or for 3 terms out of 4 correct with correct signs	M1
	$2x^2 - 7x - 4$	A1
		(2)
(b)	for expanding bracket to obtain 4 terms with all 4 correct without considering signs or for 3 terms out of 4 correct with correct signs	M1
	$9x^2 - 30xy + 25y^2$	A1
		(2)
		(4 marks)

Question	Scheme	Marks
3(a)	for expanding bracket to obtain 4 terms with all 4 correct without considering signs or for 3 terms out of 4 correct with correct signs	M1
	$x^2 + xy - 2y^2$	A1
		(2)
(b)	for correct factorisation (B1 for a partial correct factorisation which shows a product of 3 or 4 factors) $6ut^2(2u + 3t)$	B2
		(2)
		(4 marks)

Question	Scheme	Marks
4(a)	$\sqrt{50}-\sqrt{18}=5\sqrt{2}-3\sqrt{2}$	M1
	$=2\sqrt{2}$	A1
		(2)
(b)	$\dfrac{12\sqrt{3}}{\sqrt{50}-\sqrt{18}}=\dfrac{12\sqrt{3}}{"2"\sqrt{2}}$	M1
	$=\dfrac{12\sqrt{3}}{"2"\sqrt{2}}\times\dfrac{\sqrt{2}}{\sqrt{2}}=\dfrac{12\sqrt{6}}{4}$	dM1
	$=3\sqrt{6}$ or b = 3, c = 6	A1
		(3)
		(5 marks)

Question	Scheme	Marks
5	$\dfrac{7+\sqrt{5}}{\sqrt{5}-1}\times\dfrac{(\sqrt{5}+1)}{(\sqrt{5}+1)}$	M1
	$=\dfrac{\cdots}{4}$	A1 cso
	$(7+\sqrt{5})(\sqrt{5}+1)=7\sqrt{5}+5+7+\sqrt{5}$	M1
	$3+2\sqrt{5}$	A1 cso
		(4 marks)

Question	Scheme	Marks
6(a)	20	B1
		(1)
(b)	$\dfrac{\sqrt{2}}{2\sqrt{5}-3\sqrt{2}} \times \dfrac{2\sqrt{5}+3\sqrt{2}}{2\sqrt{5}+3\sqrt{2}}$	M1
	$= \dfrac{\dots}{2}$	A1
	Numerator = $\sqrt{2}(2\sqrt{5} \pm 3\sqrt{2}) = 2\sqrt{10} \pm 6$	M1
	$\dfrac{\sqrt{2}}{2\sqrt{5}-3\sqrt{2}} = \dfrac{2\sqrt{10}+6}{2} = 3+\sqrt{10}$	A1
		(4)
		(5 marks)

Question	Scheme	Marks
7(a)	$8wy^2(3wy-1)$ (B1 for a partial correct factorisation which shows a product of at least 3 factors, eg $8wy(3wy^2-y)$, $4y(6w^2y^2-2wy)$)	B2cao
		(2)
(b)	for $3e(f-1)$and $2(f-1)$ or $f(3e+2)$and $-1(3e+2)$	M1
	$(3e+2)(f-1)$	A1oe
		(2)
(c)	$(5-2x)(5+2x)$ for $(5-2x)(5+2x)$ oe, eg $-(2x-5)(2x+5)$	B1
		(1)
		(5 marks)

Question	Scheme	Marks
9(a)	$8^{\frac{1}{3}} = 2$ or $8^5 = 32768$	M1
	$\left(8^{\frac{5}{3}} =\right)$ 32	A1 cao
		(2)
(b)	$\left(2x^{\frac{1}{2}}\right)^3 = 2^3 x^{\frac{3}{2}}$	M1
	$\frac{8x^{\frac{3}{2}}}{4x^2} = 2x^{-\frac{1}{2}}$ or $\frac{2}{\sqrt{x}}$	dM1A1
		(3)
		(5 marks)

Question	Scheme	Marks
10(a)	$3x^2$	B1cao
		(1)
(b)	a^{10}	B1cao
		(1)
(c)	x^6	B1cao
		(1)
(d)	a correct first step eg $4q^2$ or $\frac{7}{2} - 2$	M1oe
	for $d = 4$	A1
	for $f = \frac{3}{2}$ oe	A1oe
		(3)
		(6 marks)

Quadratics

Mark Scheme

Question	Scheme	Marks
1(i)	$x^2-8x+17=(x-4)^2-16+17$	**M1**
	$=(x-4)^2+1$ **with comment (see notes)**	**A1**
	As $(x-4)^2\geqslant 0 \Rightarrow (x-4)^2+1\geqslant 1$ **hence** $x^2-8x+17>0$ **for all** $\boldsymbol{x}$	**A1**
		(3)
(ii)	**For an explanation that it may not always be true** **Tests say** $x=-5$ $(-5+3)^2=4$ **whereas** $(-5)^2=25$	**M1**
	States sometimes true and gives reasons **Eg. when** $\boldsymbol{x}$ **=5** $(5+3)^2=64$ **whereas** $(5)^2=25$ **True** **When** $x=-5$ $(-5+3)^2=4$ **whereas** $(-5)^2=25$ **Not true**	**A1**
		(2)
	(5 marks)	

Question	Scheme	Marks
2(a)	$x^2-10x+23=(x\pm5)^2\pm A$	M1
	$(x-5)^2-2$	A1
		(2)
(b)	$(x\pm5)^2-A\Rightarrow x=\ldots$ or $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}\Rightarrow x=\ldots$ $\left(x=\dfrac{10\pm\sqrt{10^2-4(1)(23)}}{2}\right)$	M1
	$x=5\pm\sqrt{2}$	A1
		(2)
		(5 marks)

Question	Scheme	Marks
3	$x(1-4x^2)$	B1
	Accept $x(-4x^2+1)$ or $-x(4x^2-1)$ or $-x(-1+4x^2)$ or even $4x(\frac{1}{4}-x^2)$ or equivalent quadratic (or initial cubic) into two brackets	M1
	$x(1-2x)(1+2x)$ or $-x(2x-1)(2x+1)$ or $x(2x-1)(-2x-1)$	A1
		(3)
		(3 marks)

Equations and Inequalities

Mark Scheme

Question	Scheme	Marks
2	correct expansion of both brackets or expansion of $\frac{6}{5}(2-3x)$ or $\frac{5}{6}(x+1)$	M1
	isolating terms in x, eg $7 < 23x$	M1
	$x > \dfrac{7}{23}$	A1
		(3 marks)

Question	Scheme	Marks
3(a)	writing in form $x^2 - 4x - 5\ (\geq 0)$ or $-x^2 + 4x + 5\ (\leq 0)$	M1
	establishing critical values, 5 and -1	M1
	$x \leq -1, x \geq 5$	A1
		(3)
(b)	use of $b^2 - 4ac < 0$ or $b^2 < 4ac$ or $b < 40$ or $-40 < b$	M1
	$-40 < b < 40$	A1
		(2)
		(5 marks)

Question	Scheme	Marks
4(a)	drawing $x = 3$ correctly	M1
	drawing $y - x = 5$ correctly	M1
	drawing $7x + 5y = 35$ correctly	M1
		A1
	Correct region indicated	A1
		(5)
(b)	(2, 5) (2, 6)	B1
		(2)
		(5 marks)

Notes

M1 for drawing $x = 3$ correctly
M1 for drawing $y - x = 5$ correctly
M1 for drawing $7x + 5y = 35$ correctly
A2 for correctly shading required region
(A1 for correct shading for 2 inequalities)
B1 for both correct and no extras

Question	Scheme	Marks
6	correct method to eliminate one variable	M1
	for quadratic (= 0) in one variable	M1
	correct method to solve their quadratic, eg correct factorisation or substitution into the formula	M1
	$x = -1, \ y = \frac{5}{2}$	A1
	$x = 2, \ y = -\frac{1}{2}$	A1
		(5 marks)

Notes

M1 for correct method to eliminate one variable

M1 (dep M1) for quadratic (= 0) in one variable

M1 (dep M2) for correct method to solve their quadratic,
eg correct factorisation or substitution into the formula

A1 $x = -1$, $x = 2$ or $y = \frac{5}{2}$, $y = -\frac{1}{2}$
A1 $x = -1$, $y = \frac{5}{2}$ and $x = 2$, $y = -\frac{1}{2}$
(accept coordinate pairs)

Straight Line Graphs

Mark Scheme

Question	Scheme	Marks
1(a)	$3y = 2x + 24$	M1
	$y = \frac{2}{3}x + 8$	A1
		(2)
(b)	$y = \frac{2}{3}x + c, \qquad 3y = 2x + c$	M1
	$y = \frac{2}{3}x + 1$	A1
		(2)
		(4 marks)

Notes

(a)
M1 $3y = 2x + 24$ or $y - \frac{2}{3}x = \frac{24}{3}$
A1 cao

(b)
M1 for use of correct gradient in the equation of a straight line in any form,
eg $y = \frac{2}{3}x + c$, $3y = 2x + c$
A1 for $y = \frac{2}{3}x + 1$ oe

Question	Scheme	Marks
2	States gradient of $4y-3x=10$ is $\frac{3}{4}$ oe or rewrites as $y=\frac{3}{4}x+...$	B1
	Attempts to find gradient of line joining $(5,-1)$ and $(-1,8)$	M1
	$=\frac{-1-8}{5-(-1)}=-\frac{3}{2}$	A1
	States neither with suitable reasons	A1
		(4 marks)

Notes

B1: States that the gradient of line l_1 is $\frac{3}{4}$ or writes l_1 in the form $y=\frac{3}{4}x+...$

M1: Attempts to find the gradient of line l_2 using $\frac{\Delta y}{\Delta x}$ Condone one sign error Eg allow $\frac{9}{6}$

A1: For the gradient of l_2 $=\frac{-1-8}{5-(-1)}=-\frac{3}{2}$ or the equation of l_2 $y=-\frac{3}{2}x+...$

Allow for any equivalent such as $-\frac{9}{6}$ or -1.5

A1: CSO (on gradients)

Explains that they are neither parallel as the gradients not equal nor perpendicular as $\frac{3}{4}\times-\frac{3}{2}\neq-1$ oe

Allow a statement in words "they are not negative reciprocals " for a reason for not perpendicular and "they are not equal" for a reason for not being parallel

Question	Scheme	Marks
3 **(Way 1)**	Use $y = mx + c$ with both (3, 1) and (4, -2) and attempt to find m or c	M1
	$m = -3$	A1
	$c = 10$ so $y = -3x + 10$	A1
		(3)
Or **(Way 2)**	Uses $\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$ with both (3,1) and (4, −2)	M1
	Gradient simplified to −3 (may be implied)	A1
	$y = -3x + 10$ oe	A1
		(3)
Or **(Way 3)**	Uses $ax + by + k = 0$ and substitutes both $x = 3$ when $y = 1$ and $x = 4$ when $y = -2$ with attempt to solve to find a, b or k in terms of one of them	M1
	Obtains $a = 3b$, $k = -10b$ or $3k = -10a$	A1
	Obtains $a = 3$, $b = 1$, $k = -10$ Or writes $3x + y - 10 = 0$ oe	A1
		(3)
		(3 marks)

Notes

M1: Need correct use of the given coordinates
A1: Need fractions simplified to – 3 (in way 1 and 2)
A1: Need constants combined accurately
N.B. Answer left inform (y – 1) = − 3 (x −3) or (y−(−2)) = − 3(x−4) is awarded M1A1A0 as answers should be simplified by constant being collected
Notes that a correct answer implies all three marks in this question.

Question	Scheme	Marks
4(a)	$2x+4y-3=0 \Rightarrow y=\mp\frac{2}{4}x+\ldots$ Gradient of perpendicular = $\pm\frac{4}{2}$	M1
	Either $m=2$ or $y=2x+7$	A1
		(2)
(b)	Combines 'their' $y=2x+7$ with $2x+4y-3=0 \Rightarrow 2x+4(2x+7)-3=0 \Rightarrow x=\ldots$	M1
	$x=-2.5$ oe	A1
		(2)
		(4 marks)

Notes

(a)

M1: Attempts to set given equation in the form $y=ax+b$ with $a=\mp\frac{2}{4}$ oe such as $\mp\frac{1}{2}$ **AND** deduces that $m=-\frac{1}{a}$ Condone errors on the "$+b$"

An alternative method is to find both intercepts to get gradient $l_1=\pm\frac{0.75}{1.5}$ and use the perpendicular gradient rule.

A1: Correct answer. Accept **either** $m=2$ **or** $y=2x+7$

This must be simplified and not left as $m=\frac{4}{2}$ or $m=2x$ unless you see $y=2x+7$.

Watch: There may be candidates who look at $\underset{=}{2}x+4y-3=0$ and incorrectly state that the gradient is 2 and use the perpendicular rule to get $m=-\frac{1}{2}$ They will score M0 A0 in (a) and also no marks in (b) as the lines would be parallel. In a case like this don't allow an equation to be "altered"

Candidates who state $m=2$ or $y=2x+7$ **with no incorrect working** can score both marks

(b)

M1: Substitutes their $y=mx+7$ into $2x+4y-3=0$, condoning slips, in an attempt to form and solve an equation in *x*. Alternatively equates their $y=-\frac{1}{2}x+\frac{3}{4}$ with their $y=mx+7$ in an attempt to form and solve, condoning slips, an equation in *x*. Don't be too concerned by the mechanics of the candidates attempt to solve. (E.g. allow solutions from their calculators).

You may see $2x+4y-3=2x-y+7$ with y being found before the value of *x* appears

It cannot be awarded from "unsolvable" equations (e.g. lines that are parallel).

A1: $x=-2.5$

The answer alone can score both marks as long as both equations are correct and no incorrect working is seen.

Remember to isw after the correct answer and ignore any *y* coordinate

Question	Scheme	Marks
5(a)	Gradient of $\mathbf{L_1}$ is $-\frac{3}{4}$	M1
	$y = -\frac{3}{4}x + c$ $1 = -\frac{3}{4} \times 2 + c$ $c = \frac{10}{4}$	M1
	$y = -\frac{3}{4}x + \frac{5}{2}$	A1
		(3)
(b)	Gradient of $\mathbf{L_1}$ is $-\frac{3}{4}$	M1
	Gradient of $\mathbf{L_3}$ = $\frac{4}{3}$ $y - -5 = \frac{4}{3}(x - 0)$	M1
	$4x - 3y - 15 = 0$	A1
		(3)
		(6 marks)

Notes

(a)

M1 for method to find gradient of $\mathbf{L_1}$ or sight of "$m = -\frac{3}{4}$"

M1 for method to find equation, ie use of $y - y_1 = m(x - x_1)$ or $y = mx + c$, with attempt to find c

A1 for $y = -\frac{3}{4}x + \frac{5}{2}$

(b)

M1 for method to find gradient of $\mathbf{L_3}$**,** eg use of $-\frac{1}{m}$ or sight of "$m = \frac{4}{3}$"

M1 for method to find equation, ie use of $y - y_1 = m(x - x_1)$ or $y = mx + c$, with attempt to find c

A1 for $4x - 3y - 15 = 0$ or $-4x + 3y + 15 = 0$
(accept $4x + -3y + -15 = 0$)

Algebraic methods
Mark Scheme

Question	Working	Answer	Mark	Notes
1		$\frac{x-1}{x+8}$	2	M1 for $(x-1)(x+8)$ A1cao
2	$\frac{2x(x-3)+7(x+3)}{(x+3)(x-3)}$	$\frac{2x^2+x+21}{(x+3)(x-3)}$	3	M1 for using a correct common denominator, eg $(x+3)(x-3)$ M1 for $\frac{2x(x-3)+7(x+3)}{(x+3)(x-3)}$ oe A1 for $\frac{2x^2+x+21}{(x+3)(x-3)}$ or $\frac{2x^2+x+21}{x^2-9}$
3		$\frac{5x^2-6x-12}{(3x+4)(2x-1)}$	3	M1 for using a correct common denominator A1 for $\frac{x(2x-1)+(x-3)(3x+4)}{(3x+4)(2x-1)}$ A1 for $\frac{5x^2-6x-12}{(3x+4)(2x-1)}$ or $\frac{5x^2-6x-12}{6x^2+5x-4}$
4		$\frac{1}{x^2-9}$	2	M1 for $x^2-9=(x+3)(x-3)$ or for $(x-3)^2(x+3)^2=(x^2-9)^2$ A1 for $\frac{1}{x^2-9}$ or $\frac{1}{(x+3)(x-3)}$
5	$\frac{(x-3)(x+3)}{(x-3)(x-1)}$	$\frac{x+3}{x-1}$	3	B1 for $(x-3)(x+3)$ B1for $(x-3)(x-1)$ B1 cao

Question	Working	Answer	Mark	Notes
6		$\frac{1}{u-2}$	2	M1 for factorisation of u^2-4u+4 A1

Trigonometric Ratios

Mark Scheme

<table>
<tr><th>Question</th><th>Scheme</th><th>Marks</th></tr>
<tr><td rowspan="3">1
(Way 1)</td><td>$\cos 63 = \dfrac{24.3}{(PQ)}$ or
$\sin 27 = \dfrac{24.3}{(PQ)}$ or
$\dfrac{(PQ)}{\sin 90} = \dfrac{24.3}{\sin 27}$ or $\dfrac{\sin 90}{(PQ)} = \dfrac{\sin 27}{24.3}$ oe</td><td>M1</td></tr>
<tr><td>$(PQ =)\ \dfrac{24.3}{\cos 63}$ or
$(PQ =)\ \dfrac{24.3}{\sin 27}$ or
$(PQ) = \dfrac{24.3}{\sin 27} \times \sin 90$</td><td>M1</td></tr>
<tr><td>53.5</td><td>A1</td></tr>
<tr><td rowspan="3">(Way 2)</td><td>$(RQ =) 24.3 \times \tan 63 (= 47.6914..)$</td><td>M1</td></tr>
<tr><td>$(PQ =) \sqrt{'47.6914'^2 + 24.3^2}$ oe</td><td>M1</td></tr>
<tr><td>53.5</td><td>A1</td></tr>
<tr><td colspan="3" align="right">(3 marks)</td></tr>
<tr><td colspan="3">Notes
Way 1
M1 for a correct trigonometric ratio
M1 for a correct rearrangement for PQ

Both
A1 Accept 53.5 - 53.53</td></tr>
</table>

Question	Scheme		Marks
2(a)	Finds third angle of triangle and uses or states $\dfrac{x}{\sin 60°} = \dfrac{30}{\sin"50°"}$	Finds third angle of triangle and uses or states Finds third angle of triangle and uses or states $\dfrac{y}{\sin 70°} = \dfrac{30}{\sin"50°"}$	M1
	So $x = \dfrac{30\sin 60°}{\sin 50°}$ $(= 33.9)$	So $y = \dfrac{30\sin 70°}{\sin 50°}(= 36.8)$	A1
	Area = $\frac{1}{2} \times 30 \times x \times \sin 70\ °$ or $\frac{1}{2} \times 30 \times y \times \sin 60$		M1
	= 478 m^2		A1 ft
			(4)
(b)	Plausible reason, e.g. Because the angles and the side length are not given to four significant figures Or e.g. The lawn may not be flat		B1
			(1)
			(5 marks)

Notes

(a) M1: Uses sine rule with third angle to find one of the unknown side lengths
A1: finds expression for, or value of either side length
M1: Completes method to find area of triangle
A1 ft: Obtains a correct answer for their value of x or their value of y.

(b) B1: As information given in the equation may not be accurate to 4sf or the lawn may not be flat so modelling by a plane figure may not be accurate.

Question	Scheme	Marks
3(a)	Uses $18\sqrt{3}=\frac{1}{2}\times 2x\times 3x\times \sin 60°$	M1
	Sight of $\sin 60°=\frac{\sqrt{3}}{2}$ and proceeds to $x^2=k$ oe	M1
	$x=\sqrt{12}=2\sqrt{3}$ *	A1*
		(3)
(b)	Uses $BC^2=\left(6\sqrt{3}\right)^2+\left(4\sqrt{3}\right)^2-2\times 6\sqrt{3}\times 4\sqrt{3}\times \cos 60°$	M1
	$BC^2=84$	A1
	$BC=2\sqrt{21}$ (cm)	A1
		(3)
		(6 marks)

Notes

(a)

M1: Attempts to use the formula $A=\frac{1}{2}ab\sin C$.

If the candidate writes $18\sqrt{3}=\frac{1}{2}\times 5x\times \sin 60°$ **without** sight of a previous correct line then this would be M0

M1: Sight of $\sin 60°=\frac{\sqrt{3}}{2}$ or awrt 0.866 and proceeds to $x^2=k$ oe such as $px^2=q$

This may be awarded from the correct formula or $A=ab\sin C$

A1*: Look for $x^2=12\Rightarrow x=2\sqrt{3}$, $x^2=4\times 3\Rightarrow x=2\sqrt{3}$ or $x=\sqrt{12}=2\sqrt{3}$

This is a given answer and all aspects must be correct including one of the above intermediate lines. It cannot be scored by using decimal equivalents to $\sqrt{3}$

Alternative using the given answer of $x=2\sqrt{3}$

M1: Attempts to use the formula $A=\frac{1}{2}\times 4\sqrt{3}\times 6\sqrt{3}\sin 60°$ oe

M1: Sight of $\sin 60°=\frac{\sqrt{3}}{2}$ and proceeds to $A=18\sqrt{3}$

A1*: Concludes that $x=2\sqrt{3}$

(b)

M1: Attempts the cosine rule with the sides in the correct position.

This can be scored from $BC^2=(3x)^2+(2x)^2-2\times 3x\times 2x\times \cos 60°$ as long as there is some attempt to substitute x in later.

Condone slips on the squaring

A1: $BC^2=84$ Accept $BC^2=7\times 12$, $BC=\sqrt{84}$ or $BC=2\sqrt{21}$

If they replace the surds with decimals they can score the A1 for $BC^2=$ awrt 84.0

A1: $BC=2\sqrt{21}$

Condone other variables, say $x=2\sqrt{21}$, but it cannot be scored via decimals.

Vectors

Mark Scheme

Question	Scheme	Marks
2 (a)	Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1
	$\overrightarrow{AB} = 5\mathbf{i} + 10\mathbf{j}$	A1
		(2)
(b)	Finds length using Pythagoras: $\lvert AB \rvert = \sqrt{(5)^2 + (10)^2}$	M1
	$\lvert AB \rvert = 5\sqrt{5}$	A1 ft
		(2)
		(4 marks)

Question	Scheme	Marks
3 (a)	Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1
	$\overrightarrow{AB} = -9\mathbf{i} + 3\mathbf{j}$	A1
		(2)
(b)	Finds length using 'Pythagoras' $\lvert AB \rvert = \sqrt{(-9)^2 + (3)^2}$	M1
	$\lvert AB \rvert = 3\sqrt{10}$	A1ft
		(2)
		(4 marks)