L6 Assessment 1 – Mark Scheme

QUESTION 1

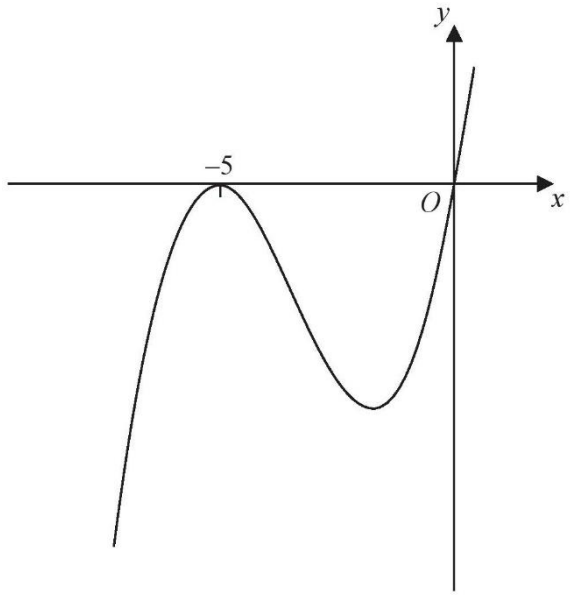
Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$g(-2) = (4 \times -8) - (12 \times 4) - (15 \times -2) + 50$	M1	This mark is given for an attempt to find g(–2)
	g(–2) = 0, thus $(x + 2)$ is a factor	A1	This mark is given for finding that g(–2) = 0 and stating a correct conclusion
(b)	$4x^3 - 12x^2 - 15x + 50$	M1	This mark is given for an attempt to divide $4x^3 - 12x^2 - 15x + 50$ by $(x + 2)$
	$= (x + 2)(4x^2 - 20x + 25)$	A1	This mark is given for correctly dividing $4x^3 - 12x^2 - 15x + 50$ by $(x + 2)$
	$= (x + 2)(2x \pm \ldots)(2x \pm \ldots)$	M1	This mark is given for an attempt to factorise $(4x^2 - 20x + 25)$
	$= (x + 2)(2x - 5)^2$	A1	This mark is given for a correct answer

QUESTION 2

Part	Working or answer an examiner might expect to see	Mark	Notes
	$1 + 11x - 6x^2 \equiv$ $A(1 - 2x)(x - 3) + B(1 - 2x) + C(x - 3)$	M1	This mark is given for using a correct identity to find B and C
	$6 = 2A$, $A = 3$	B1	This mark is given for comparing x^2 coefficients to find a value for A
	Substituting $x = 3$ gives $1 + (11 \times 3) - (6 \times 3^2) = B \times (1 - 2 \times 6)$ $-20 = -5B$ Substituting $x = \frac{1}{2}$ gives $1 + (11 \times \frac{1}{2}) - (6 \times \frac{1}{2}^2) = C \times (\frac{1}{2} - 3)$ $5 = -2\frac{1}{2}C$	M1	This mark is given for a method to find the values of B and C
	$B = 4$, $C = -2$	A1	This mark is given for the correct answers only

Question	Scheme	Marks	AOs
	$\frac{1+11x-6x^2}{(x-3)(1-2x)} \equiv A + \frac{B}{(x-3)} + \frac{C}{(1-2x)}$		
Way 1	$1+11x-6x^2 \equiv A(1-2x)(x-3)+B(1-2x)+C(x-3) \Rightarrow B=..., C=...$	M1	2.1
	$A=3$	B1	1.1b
	Uses substitution or compares terms to find either $B=...$ or $C=...$	M1	1.1b
	$B=4$ and $C=-2$ which have been found using a correct identity	A1	1.1b
		(4)	
Way 2	{long division gives} $\frac{1+11x-6x^2}{(x-3)(1-2x)} \equiv 3 + \frac{-10x+10}{(x-3)(1-2x)}$		
	$-10x+10 \equiv B(1-2x)+C(x-3) \Rightarrow B=..., C=...$	M1	2.1
	$A=3$	B1	1.1b
	Uses substitution or compares terms to find either $B=...$ or $C=...$	M1	1.1b
	$B=4$ and $C=-2$ which have been found using $-10x+10 \equiv B(1-2x)+C(x-3)$	A1	1.1b
		(4)	

QUESTION 3

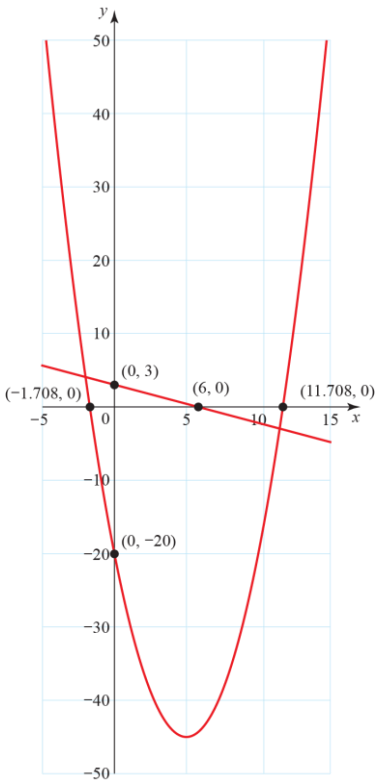
(a)	$x^3+10x^2+25x=x(x^2+10x+25)$ $=x(x+5)^2$	M1 A1 (2)
(b)	 A cubic with correct orientation Curve passes through the origin (0, 0) and touches at (− 5, 0)	M1 A1 ft (2)

Notes

(a) M1: Takes out factor x
A1: Correct factorisation - allow $x(x+5)(x+5)$

(b) M1: Correct shape
A1ft: Curve passes through the origin (0, 0) and touches at (− 5, 0) – allow follow through from incorrect factorisation

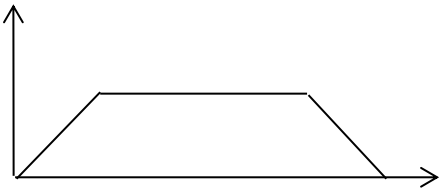
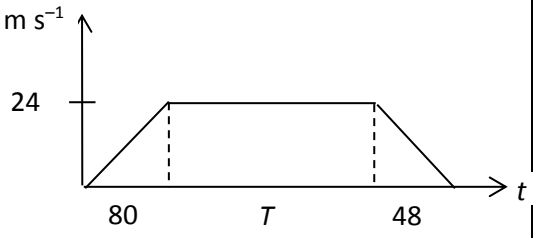
QUESTION 4

<table>
<tr><th>Q</th><th colspan="2">Scheme</th><th>Marks</th><th>AOs</th><th></th></tr>
<tr><td>a</td><td>Figure 1
 
</td><td>q(0) = −20, so y = q(x) intersects y-axis at (0, −20) and 2 x-intercepts, with correct shape</td><td>B1</td><td>1.1b</td><td rowspan="4">3rd
Sketch graphs of quadratic functions</td></tr>
<tr><td></td><td></td><td>y = p(x) intersects y-axis at (0, 3).</td><td>B1</td><td>1.1b</td></tr>
<tr><td></td><td></td><td>y = p(x) intersects x-axis at (6, 0).</td><td>B1</td><td>1.1b</td></tr>
<tr><td></td><td></td><td>Graphs drawn as shown with all axes intercepts labelled, including $5+3\sqrt{5}$ and $5-3\sqrt{5}$ for the quadratic x-intercepts.
The two graphs should clearly intersect at two points, one at a negative value of x and one at a positive value of x. These points of intersection do not need to be labelled.</td><td>B1</td><td>1.1b</td></tr>
<tr><td>b</td><td colspan="2">Statement indicating that this is the point where p(x) = q(x)
or $x^2-10x-20=3-\frac{1}{2}x$ seen.</td><td>M1</td><td>2.2a</td><td rowspan="4">4th
Solve more complicated simultaneous equations where one is linear and one is quadratic</td></tr>
<tr><td></td><td colspan="2">Their equation factorised, or attempt to solve their equation by completing the square.
$2x^2-19x-46=0$
$(2x-23)(x+2)=0$</td><td>M1</td><td>1.1b</td></tr>
<tr><td></td><td colspan="2">$\left(\frac{23}{2},-\frac{11}{4}\right)$</td><td>A1</td><td>1.1b</td></tr>
<tr><td></td><td colspan="2">$(-2,4)$</td><td>A1</td><td>1.1b</td></tr>
<tr><td colspan="6">Notes
B If the student incorrectly writes the initial equation, award 1 method mark for an attempt to solve the incorrect equation. Solving the correct equation by either factorising or completing the square is acceptable.</td></tr>
</table>

QUESTION 5

Question	Scheme	Marks	AOs
	$3x-2y=k$ intersects $y=2x^2-5$ at two distinct points		
	Eliminate y and forms quadratic equation = 0 or quadratic expression $\{=0\}$	M1	3.1a
	$\{3x-2(2x^2-5)=k \Rightarrow\} \; -4x^2+3x+10-k=0$	A1	1.1b
	$\{"b^2-4ac">0 \Rightarrow\} \; 3^2-4(-4)(10-k)>0$	dM1	2.1
	$9+16(10-k)>0 \Rightarrow 169-16k>0$		
	Critical value obtained of $\frac{169}{16}$	B1	1.1b
	$k<\frac{169}{16}$ o.e.	A1	1.1b
		(5)	
Alt 1	Eliminate y and forms quadratic equation = 0 or quadratic expression $\{=0\}$	M1	3.1a
	$y=2\left(\frac{1}{3}(k+2y)\right)^2-5 \Rightarrow y=\frac{2}{9}(k^2+4ky+4y^2)-5$		
	$8y^2+(8k-9)y+2k^2-45=0$	A1	1.1b
	$\{"b^2-4ac">0 \Rightarrow\} \; (8k-9)^2-4(8)(2k^2-45)>0$	dM1	2.1
	$64k^2-144k+81-64k^2+1440>0 \Rightarrow -144k+1521>0$		
	Critical value obtained of $\frac{169}{16}$	B1	1.1b
	$k<\frac{169}{16}$ o.e.	A1	1.1b
		(5)	
Alt 2	$\frac{dy}{dx}=4x, m_l=\frac{3}{2} \Rightarrow 4x=\frac{3}{2} \Rightarrow x=\frac{3}{8}$. So $y=2\left(\frac{3}{8}\right)^2-5=-\frac{151}{32}$	M1	3.1a
		A1	1.1b
	$k=3\left(\frac{3}{8}\right)-2\left(-\frac{151}{32}\right) \Rightarrow k=...$	dM1	2.1
	Critical value obtained of $\frac{169}{16}$	B1	1.1b
	$k<\frac{169}{16}$ o.e.	A1	1.1b
		(5)	
			(5 marks)

QUESTION 6

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)(i)	$0.3 \text{ m s}^{-2} \times 80 \text{ s} = 24 \text{ m s}^{-1}$	B1	This mark is given for 24
(a)(ii)	$24 \text{ m s}^{-1} \div 0.5 \text{ m s}^{-2} = 48 \text{ s}$	B1	This mark is given for 48
(a)(iii)		B1	This mark is given for trapezium starting at the origin and ending on the *t*-axis.
(b)		M1	This mark is given for a complete method to find area of trapezium (including all 3 parts, and $\frac{1}{2}$ used at least once) and equating its area to 4800
	$\frac{1}{2}(a + b)h$ = $\frac{1}{2}(T + T + 80 + 48) \times 24 = 4800$	A1	This mark is given for a fully correct equation
	$2T + 128 = 400$ $T = 136$ Total time is $136 + 80 + 48 = 264$ s	A1	This mark is given for 264
(c)	Allow a smooth change from acceleration to constant velocity Corners of the trapezium are too sharp for a realistic model	B1	This mark is given for a suitable statement

(c)	Accept **Either:** a smooth change from acceleration to constant velocity or from constant velocity to deceleration. **Or** have train accelerating and/or decelerating at a variable rate Do not accept e.g. Comments on air resistance or resistive forces, straightness of track, horizontal track, friction, length of train, mass of train, not having train moving with constant velocity. B0 if either an incorrect extra is included or an incorrect reason for a valid improvement is included. N.B. Variable acceleration due to air resistance is B0 **BUT** Variable acceleration due to **variable** air resistance is B1	B1	3.5c

QUESTION 7

Part	Working or answer an examiner might expect to see	Mark	Notes
	$-2 = 9t - (\frac{1}{2} \times 10t^2)$	M1	This mark is given for a complete method to give equation in t only
	$5t^2 - 9t = 2$	A1	This mark is given for a correct equation
	$5t^2 - 9t - 2 = 0 = (5t + 1)(t - 2)$	dM1	This mark is given for finding and solving a quadratic equation
	$T = 2$	A1	This mark is given for a correct answer only

QUESTION 8

Question	Scheme	Marks	AOs
	Using a correct strategy for solving the problem by setting up two equations in a and u only and solving for either	M1	3.1b
	Equation in a and u only	M1	3.1b
	$22 = 2u + \frac{1}{2} a\, 2^2$	A1	1.1b
	Another equation in a and u only	M1	3.1b
	$126 = 6u + \frac{1}{2} a\, 6^2$	A1	1.1b
	5 m s^{-2}	A1	1.1b
	6 m s^{-1}	A1 **ft**	1.1b
			(7 marks)

Notes

1st M1 for solving the problem by setting up two equations in a and u only and solving for either
2nd M1 use of (one or more) *suvat* formulae to produce equation in u and a only
1st A1 for a correct equation
3rd M1 use of (one or more) *suvat* formulae to produce another equation in u and a only
2nd A1 for a correct equation
3rd A1 for correct accln 5 m s^{-2}
4th A1 for correct speed 6 m s^{-1} (The second of these A marks is an **ft** mark, following an incorrect value for u or a, depending on which has been found first)
N.B. Do not award the **ft** mark for absurd answers e.g. $a > 15$, $u > 50$

See alternative on next page

ALTERNATIVE

Question	Scheme	Marks	AOs
	Using a correct strategy for solving the problem by obtaining actual speeds at two times and using $a =$ change in speed / time taken.	M1	3.1b
	Actual speed at $t = 1$ = Average speed over interval	M1	3.1b
	$22/2 = 11$	A1	1.1b
	Actual speed at $t = 4$ = Average speed over interval	M1	3.1b
	$104/4 = 26$	A1	1.1b
	$5\ m\ s^{-2}$	A1	1.1b
	$6\ m\ s^{-1}$	A1 **ft**	1.1b
			(7 marks)

Notes

1st M1 for solving the problem by obtaining two actual speeds and use of $a = (v - u)/t$
2nd M1 use of speed at half-time = av speed over interval to produce a speed at $t = 1$
1st A1 for a correct speed
3rd M1 use of speed at half-time = av speed over interval to produce a speed at $t = 4$
2nd A1 for a correct speed
3rd A1 for correct accln $5\ m\ s^{-2}$
4th A1 **ft** for correct speed $6\ m\ s^{-1}$ (This is an ft mark, following an incorrect value of a)
N.B. Do not award the **ft** mark for absurd answers e.g. $a > 15$, $u > 50$