Year 1 – Week 12 Exam Questions

Mark Scheme

Question 1

m = -3	*(1 mark)*
Use of y -y1 = m(x – x1) with (3 , 1) or (4, -2)	*(1mark)*
$y = -3x + 10$ o.e	*(1mark)*

N.B. Answer left in the form $(y-1) = -3(x-3)$ or $(y-(-2)) = -3(x-4)$ is awarded M1A1A0 as answers should be simplified by constants being collected

i.e. scores 2 out of 3

Question 2

Attempts $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$ or similar	M1
$\overrightarrow{AB} = 5\mathbf{i} + 10\mathbf{j}$	A1
	(2)
Finds length using 'Pythagoras' $\lvert AB \rvert = \sqrt{(5)^2 + (10)^2}$	M1
$\lvert AB \rvert = 5\sqrt{5}$	A1ft
	(2)

Question 3

(a)	States or uses $f(+3) = 0$	M1
	$4(3)^3 - 12(3)^2 + 2(3) - 6 = 108 - 108 + 6 - 6 = 0$ and so $(x-3)$ is a factor	A1
		(2)
(b)	Begins division or factorisation so x $4x^3 - 12x^2 + 2x - 6 = (x-3)(4x^2 + \ldots)$	M1
	$4x^3 - 12x^2 + 2x - 6 = (x-3)(4x^2 + 2)$	A1
	Considers the roots of their quadratic function using completion of square or discriminant	M1
	$(4x^2 + 2) = 0$ has no real roots with a reason (e.g. negative number does not have a real square root, or $4x^2 + 2 > 0$ for all x. So $x = 3$ is the only real root of $f(x) = 0$ *	A1*
		(4)

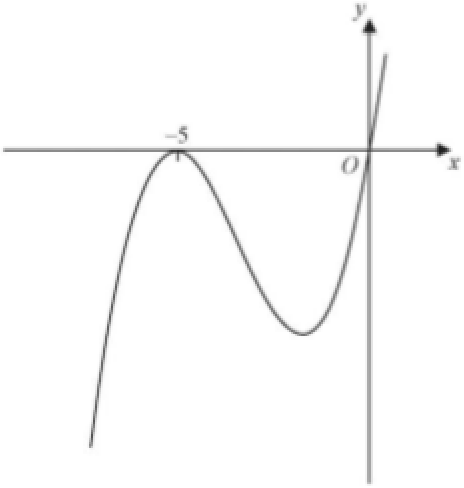
Question 4

Realises that $k=0$ will give no real roots as equation becomes $3=0$ (proof by contradiction)	B1
(For $k \neq 0$) quadratic has no real roots provided $b^2 < 4ac$ so $16k^2 < 12k$	M1
$4k(4k-3) < 0$ with attempt at solution	M1
So $0 < k < \frac{3}{4}$, which together with $k=0$ gives $0 \leqslant k < \frac{3}{4}$ *	A1*

Question 5

17 (a)	**Way 1:** Finds circle equation $(x \pm 2)^2 + (y \mp 6)^2 = (10 \pm (-2))^2 + (11 \mp 6)^2$	**Way 2:** Finds distance between $(-2, 6)$ and $(10, 11)$	M1
	Checks whether (10, 1) satisfies their circle equation	Finds distance between $(-2, 6)$ and $(10, 1)$	M1
	Obtains $(x+2)^2 + (y-6)^2 = 13^2$ and checks that $(10+2)^2 + (1-6)^2 = 13^2$ so states that (10, 1) lies on C *	Concludes that as distance is the same (10, 1) lies on the circle C *	A1*
			(3)
(b)	Finds radius gradient $\frac{11-6}{10-(-2)}$ or $\frac{1-6}{10-(-2)}$ (m)		M1
	Finds gradient perpendicular to their radius using $-\frac{1}{m}$		M1
	Finds (equation and) y intercept of tangent (see note below)		M1
	Obtains a correct value for y intercept of their tangent i.e. 35 or −23		A1
	Way 1: Deduces gradient of second tangent	**Way 2**: Deduces midpoint of PQ from symmetry (0, 6)	M1
	Finds (equation and) y intercept of second tangent	Uses this to find other intercept	M1
	So obtains distance PQ = 35 + 23= 58*		A1*
			(7)

Question 6

13(a)	$x^3+10x^2+25x=x(x^2+10x+25)$		M1
	$=x(x+5)^2$		A1
			(2)
(b)		A cubic with correct orientation	M1
		Curve passes through the origin (0, 0) and touches at (−5, 0) (see note below for ft)	A1ft
			(2)
(c)	Curve has been translated a to the left		M1
	$a=-2$		A1ft
	$a=3$		A1ft
			(3)

Question 7

Using distance = total area under graph (e.g. area of rectangle + triangle **or** trapezium **or** rectangle – triangle)	M1
e.g. $D = UT + ½\ Th$, where h is height of triangle	A1
Using gradient = acceleration to substitute $h = aT$	M1
$D = UT + ½\ aT^2$ *	A1 *
	(4)

Question 8

'(i)(ii)	Using a correct strategy for solving the problem by setting up two equations in a and u only and solving for either	M1
	Equation in a and u only	M1
	$22 = 2u + \frac{1}{2} a\, 2^2$	A1
	Another equation in a and u only	M1
	$126 = 6u + \frac{1}{2} a\, 6^2$	A1
	5 m s^{-2}	A1
	6 m s^{-1}	A1ft

(7 m