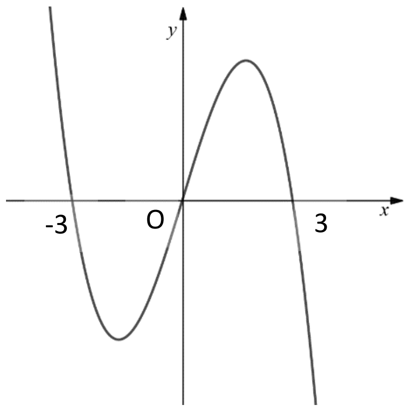
<table>
<tr><th>Question</th><th colspan="2">Scheme</th><th>Marks</th><th>AOs</th></tr>
<tr><td rowspan="3">7(a)</td><td colspan="2">$9x - x^3 = x\left(9 - x^2\right)$</td><td>M1</td><td>1.1b</td></tr>
<tr><td colspan="2">$9x - x^3 = x\left(3 - x\right)\left(3 + x\right)$ oe</td><td>A1</td><td>1.1b</td></tr>
<tr><td colspan="2"></td><td>(2)</td><td></td></tr>
<tr><td rowspan="3">(b)</td><td rowspan="2"></td><td>A cubic with correct orientation</td><td>B1</td><td>1.1b</td></tr>
<tr><td>Passes though origin, (3, 0) and (–3, 0)</td><td>B1</td><td>1.1b</td></tr>
<tr><td colspan="2"></td><td>(2)</td><td></td></tr>
<tr><td rowspan="4">(c)</td><td colspan="2">$y = 9x - x^3 \Rightarrow \dfrac{\mathrm{d}y}{\mathrm{d}x} = 9 - 3x^2 = 0 \Rightarrow x = (\pm)\sqrt{3} \Rightarrow y = \ldots$</td><td>M1</td><td>3.1a</td></tr>
<tr><td colspan="2">$y = (\pm)6\sqrt{3}$</td><td>A1</td><td>1.1b</td></tr>
<tr><td colspan="2">$\left\{k \in \mathbb{R} : -6\sqrt{3} < k < 6\sqrt{3}\right\}$ oe</td><td>A1ft</td><td>2.5</td></tr>
<tr><td colspan="2"></td><td>(3)</td><td></td></tr>
<tr><td colspan="5" align="right">(7 marks)</td></tr>
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Notes

(a)

M1: Takes out a factor of x or $-x$. Scored for $\pm x(\pm 9 \pm x^2)$ May be implied by the correct answer or $\pm x\left(\pm x \pm 3\right)\left(\pm x \pm 3\right)$.

Also allow if they attempt to take out a factor of $(\pm x \pm 3)$ so score for $(\pm x \pm 3)(\pm 3x \pm x^2)$

A1: Correct factorisation. $x\left(3 - x\right)\left(3 + x\right)$ on its own scores M1A1.

Allow eg $-x\left(x-3\right)\left(x+3\right)$, $x\left(x-3\right)\left(-x-3\right)$ or other equivalent expressions

Condone an = 0 appearing on the end and condone eg x written as $(x+0)$.

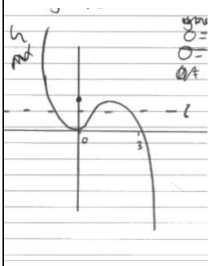
(b)

B1: Correct shape (negative cubic) appearing anywhere on a set of axes. It must have a minimum to the left and maximum to the right. Be tolerant of pen slips. Judge the intent of the shape. (see examples)

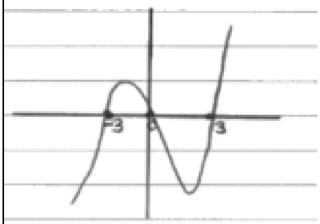
B1: Passes **through** each of the origin, (3, 0) and (–3, 0) and no other points on the x axis. (The graph should not turn on any of these points).
The points may be indicated as just 3 and -3 on the axes. Condone x and y to be the wrong way round eg $(0, -3)$ for (–3, 0) as long as it is on the correct axis but do not allow (–3, 0) to be labelled as (3, 0).

Examples

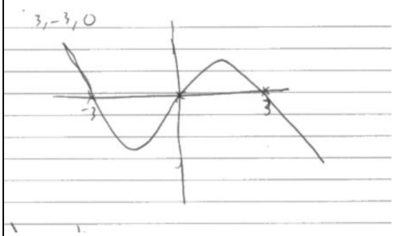
B1B0

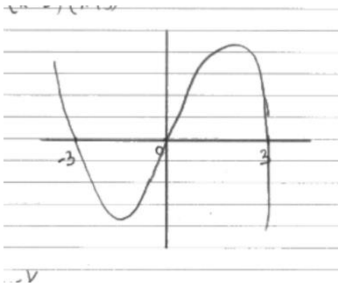


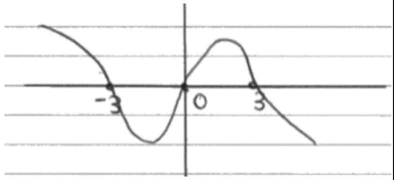
B0B1



B1B1







(c) ***Be aware the value of *y* can be solved directly using a calculator which is not acceptable***

M1: Uses a correct strategy for the *y* value of either the maximum or minimum. E.g. differentiates to achieve a quadratic, solves $\frac{\mathrm{d}y}{\mathrm{d}x}=0$ and uses their *x* to find *y*

A1: Either or both of the values $(\pm)6\sqrt{3}$.

Cannot be scored for an answer without any working seen.

A1ft: Correct answer in any acceptable set notation following through their $6\sqrt{3}$.

Condone $\left\{"-6\sqrt{3}"<k<"6\sqrt{3}"\right\}$ or $\left\{"-6\sqrt{3}"<k\right\}\cap\left\{k<"6\sqrt{3}"\right\}$ but not $\left\{"-6\sqrt{3}"<k\right\}\cup\left\{k<"6\sqrt{3}"\right\}$

Note: If there is a contradiction of their solution on different lines of working do not penalise intermediate working and mark what appears to be their final answer.

Must be in terms of *k*