Question Number	Scheme	Marks
5 (a)	$\mathrm{f}(x)=3x^3+ax^2-10x+b$	
	$\mathrm{f}\left(\frac{4}{3}\right)=0\Rightarrow 3\times\left(\frac{4}{3}\right)^3+a\left(\frac{4}{3}\right)^2-10\left(\frac{4}{3}\right)+b=0$	M1
	$\frac{64}{9}+\frac{16}{9}a-\frac{40}{3}+b=0\Rightarrow 64+16a-120+9b=0\ \ \Rightarrow 16a+9b=56$ *	A1*
		(2)
(b)	$\mathrm{f}(2)=b\Rightarrow 3\times(2)^3+a(2)^2-10(2)+b=b$ leading to an equation in just a	M1
	$4a=-4\Rightarrow a=-1$	A1
	Substitutes $a=\text{'}-1\text{'}$ in $-16+9b=56\Rightarrow b=...$	M1
	$\Rightarrow b=8$	A1
		(4)
(c)	$\mathrm{f}(x)=3x^3-x^2-10x+8=(3x-4)(x^2+x-2)$	M1, A1
	$=(3x-4)(x+2)(x-1)$	A1
		(3)
		(9 marks)

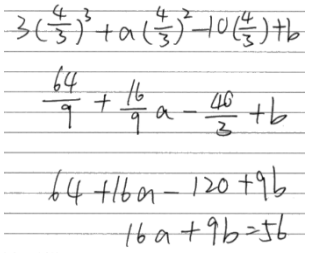
(a)

M1: Sets $\mathrm{f}\left(\frac{4}{3}\right)=0$ producing an equation in a and b. Condone slips but the intention must be clear.

For example, $3\times\frac{4^3}{3}+a\times\frac{4^2}{3}-10\times\frac{4}{3}+b=0$ is incorrect but the intention is clear and scores M1, A0

Finding a simplified $\mathrm{f}\left(\frac{4}{3}\right)=\frac{64}{9}+\frac{16}{9}a-\frac{40}{3}+b=\frac{16}{9}a-\frac{56}{9}+b$ before setting it equal to 0 is acceptable

Candidates who find $\mathrm{f}\left(\frac{4}{3}\right)$ and proceed to a correct equation without ever stating $\mathrm{f}\left(\frac{4}{3}\right)=0$ or setting their expression for $\mathrm{f}\left(\frac{4}{3}\right)$ equal to 0 can be awarded M1, A0 by implication.



Example of M1 A0*:

Candidate attempts $\mathrm{f}\left(\frac{4}{3}\right)$ which they then simplify (and then multiply by 9)

The final line implies $9\times\mathrm{f}\left(\frac{4}{3}\right)=0$ and so implies $\mathrm{f}\left(\frac{4}{3}\right)=0$

Setting $\mathrm{f}\left(-\frac{4}{3}\right)=0$ is M0

A1*: Shows that $16a+9b=56$. This is a given answer so there must be no incorrect lines (no recovery) or working. You do not explicitly need to see the $\text{'f}\left(\frac{4}{3}\right)\text{'}$ just its result, see below.

It is acceptable to have just one correct intermediate line with either collected terms or non-fractional coefficients between $3\times\left(\frac{4}{3}\right)^3+a\left(\frac{4}{3}\right)^2-10\left(\frac{4}{3}\right)+b=0$ and $16a+9b=56$

For example: $3\times\left(\frac{4}{3}\right)^3+a\left(\frac{4}{3}\right)^2-10\left(\frac{4}{3}\right)+b=0\Rightarrow\frac{16}{9}a+b-\frac{56}{9}=0\Rightarrow 16a+9b=56$ scores M1 A1

as does $3\times\left(\frac{4}{3}\right)^3+a\left(\frac{4}{3}\right)^2-10\left(\frac{4}{3}\right)+b=0\Rightarrow 64+16a-120+9b=0\Rightarrow 16a+9b=56$

(b)

M1: Attempts to set $\mathrm{f}(2)=b$ and proceeds to form an equation in just a.

Condone slips but setting $\mathrm{f}(-2)=b$ is M0

A1: $a=-1$

M1: Substitutes their value of a found from the equation $\mathrm{f}(\pm 2)=b$ into $16a+9b=56$ and finds a value for b

A1: $b=8$

(c)

M1: Attempts to divide $\mathrm{f}(x)$ by $(3x-4)$. Alternatively attempts to factorise out $(3x-4)$

Look for two 'correct' terms via either method.

E.g. via factorisation look at first and last terms $3x^3+ax^2-10x+b=(3x-4)\left(x^2+\ldots x\pm\frac{"b"}{4}\right)$

via division look for first two terms $3x-4\overline{)\;3x^3+ax^2-10x+b}$ $\quad x^2+\left(\frac{a+4}{3}\right)x\ldots\ldots\ldots\ldots$

for their numerical values of a and b

The demand of the question is 'Hence', so the candidates must use the information given, that is $(3x-4)$ is a factor. Do not accept division or factorisation by other factors.

A1: Achieves the correct quadratic factor of $\left(x^2+x-2\right)$

A1: Fully factorised form required $(3x-4)(x+2)(x-1)$ all together on one line.

It can only be scored following M1. ISW if you see the addition of $=0$ and perhaps roots

You will see attempts that factorise attempt to $\mathrm{f}(x)$ via factors formed via calculator methods. These should be scored M0, A0, A0

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Alt (c).

M1: Candidates can attempt to divide by $(x-1)$ or $(x+2)$ only if they have firstly proven/shown that $\mathrm{f}(1)=0$ or $\mathrm{f}(-2)=0$. This can be marked in a similar way to the main scheme and can only really follow a correct $\mathrm{f}(x)$. So expect to see $\mathrm{f}(x)=3x^3-x^2-10x+8$ with, for example, $\mathrm{f}(1)=3-1-10+8=0\Rightarrow(x-1)$ is a factor. Then division by $(x-1)$ with similar conditions as the main scheme.

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Inevitably we will see attempts at parts (a) and (b) via a table or by division. This is acceptable.

For example:

In part (a), award M1 for an attempt at

$$3x-4\overline{)\;3x^3+ax^2-10x+b}\quad x^2\ldots\ldots\ldots\ldots$$

that achieves a quadratic quotient and a remainder which is set = 0

Then award A1 if it is correct. For example, $b+4\left(\frac{4}{9}a-\frac{14}{9}\right)=0\Rightarrow\ 16a+9b=56$

In part (b), award M1 for an attempt at

$$x-2\overline{)3x^3+ax^2-10x+b}\qquad 3x^2+.....$$

that achieves a quadratic quotient and a remainder which is set = b

Then award A1 if it is correct. For example, $4a+4+b=b \Rightarrow a=-1$

If in doubt then please send to review

Question Number	Scheme	Marks
6(a)	States or uses $M=(5,4)$ **or** grad $AB=\frac{1}{3}$ o.e.	B1
	States or uses $M=(5,4)$ **and** grad $AB=\frac{1}{3}$ o.e.	B1
	Equation of l is $y-4=-3(x-5)$	M1
	$y=-3x+19$	A1
		(4)
(b)	$k=-2$	B1 ft
		(1)
(c)	Attempts radius or radius ^{2} E.g. $(11-7)^2+(6--2)^2$	M1
	States $(x-7)^2+(y+'2')^2=(11-7)^2+(6--2)^2$	dM1
	$(x-7)^2+(y+2)^2=80$	A1
		(3)
		(8 marks)

(a)

B1: States or uses $M=(5,4)$ **or** grad $AB=\frac{1}{3}$ o.e. such as $\frac{4}{12}$

Note that gradient AB may be implied by use of a gradient for l of -3 o.e.

B1: States or uses $M=(5,4)$ **and** grad $AB=\frac{1}{3}$ o.e. such as $\frac{4}{12}$

Note that gradient AB may be implied by use of a gradient for l of -3 o.e.

M1: Attempts equation of l using their M and their correctly adapted gradient.

The gradient used must be the negative reciprocal of their gradient of AB. If it just appears without any working it must be correct.

If the form $y=mx+c$ is used this mark is only scored when they proceed as far as $c=\ldots$

A1: CAO $y=-3x+19$

(b)

B1ft: $k=-2$ or follow through on the value of their $'-3'\times 7+'19'$

Allow this to be scored if the coordinates of P are given.

For example, as $(7,-2)$ or even $y=-2$ following use of 7

(c)

M1: Attempts either the radius^2 or the radius using their $(7,k)$ and one of the given points

E.g. $(11-7)^2+(6-'-2')^2$ or $\sqrt{\left(7-(-1)\right)^2+('-2'-2)^2}$

It does not need to be correctly identified as r or r^2

dM1: Attempts equation of circle using their radius ^{2} and their $(7,k)$

Note that $(x-7)^2+(y-'k')^2=(11-7)^2+(6-'k')^2$ would score M1 dM1

A1: $(x-7)^2+(y+2)^2=80$ The rhs of the equation must be simplified and ISW after a correct answer.

Alt (c)

M1: Writes equation of circle as $x^2+y^2-14x-2'k'y=\lambda$ following through on their k

dM1: Substitutes $(-1,2)$ or $(11,6)$ into the equation of the circle and finds a value for λ