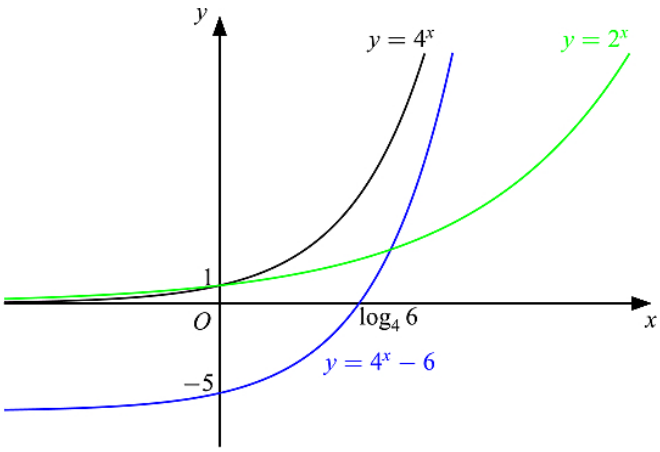
Question	Scheme		Marks
2(a)		(i) Correct shape and position for $y = 2^x$ Crosses y axis with same intersection as $y = 4^x$ but with gentler slope.	**B1**
		(ii) Graph of same shape as $y = 4^x$ but translated down	**B1**
		y intercept at -5	**B1**
		x intercept at $\log_4 6$	**B1**
			(4)
(b)	$2^x = 4^x - 6$ or $y = (2^x)^2 - 6 = y^2 - 6$		**M1**
	$\Rightarrow 2^{2x} - 2^x - 6 = 0 \Rightarrow (2^x - 3)(2^x + 2) = 0 \Rightarrow 2^x = \ldots$ or $(y-3)(y+2) = 0 \Rightarrow y = \ldots$		**M1**
	$y = 2^x = 3$		**A1**
	$x = \log_2 3$ oe		**A1**
			(4)
			(8 marks)

Notes:

(a)(i)

Note: Be tolerant of "wobbles" in the graph if it is clear the correct shapes are meant, but the graph must not clearly bend away from the asymptotes.

B1: Correct sketch for $y = 2^x$. This should be correct shape, but shallower gradient – look for crossing at same y intercept as $y = 4^x$, above $y = 4^x$ to the left of the y axis and below $y = 4^x$ to the right of the y axis.

(ii)

B1: Graph of $y = 4^x$ translated down by 6 units. Look for the same shape, always below $y = 4^x$ though be tolerant as the graph increases (accept if the graphs don't "narrow" as shown).

B1: Correct y intercepts of -5

B1: Correct x intercept of $\log_4 6$. Accept equivalents such as $\log 6 / \log 4$ or awrt 1.29

Ignore any references to asymptotes for these marks.

(b)

M1: Sets the equations equal to form an equation in x only, or writes 4^x in terms of 2^x and substitutes to achieve an equation in y only.

M1: Solves the equation to find a value for 2^x or y

A1: Correct y (or 2^x) value of intersection. (May have second solution)

A1: Correct x value of intersection. Must have rejected second "solution". Accept exact equivalents, such as $\log 3 / \log 2$ or $2\log_4 3$

Question	Scheme	Marks
3(i)	At least three of: For $p=2:\ 2^3+2=8+2=10$; For $p=3:\ 3^3+3=27+3=30$ For $p=5:\ 5^3+5=125+5=130$; For $p=7:\ 7^3+7=343+7=350$	**M1**
	Each case gives a multiple of 10. As 2,3,5 and 7 are the only single digit primes, the result has been proved for all single digit primes.	**A1**
		(2)
(ii)	$(n+1)^3-n^3=n^3+3n^2+3n+1-n^3=3n^2+3n+1$	**M1A1**
	$=3(n^2+n)+1$ which is one more than a multiple of 3, so is not divisible by 3 for any $n\in\mathbb{N}$	**A1**
		(3)
		(5 marks)

Notes:

(i)

M1: Checks result for at least three of the four single digit primes (2,3,5 and 7) – attaining a multiple of 10 is enough, no need to see the product. Allow if there are slips.

A1: All four cases correctly checked, with minimal conclusion that the result is true. Ignore checks on non-prime values such as $p = 8$ which gives $8^3+8=520$, but award A0 if the case $p = 1$, leads to a conclusion that the result is not true.

(ii)

M1: Expands to a four term cubic (may have incorrect coefficients) and then cancels the n^3 terms (if $n = 2k$ and $n = 2k + 1$ are used, both must be attempted.)

A1: Correct quadratic in n. (Both correct if $n = 2k$ and $n = 2k + 1$ are used)

A1: Correct explanation and conclusion given. For the explanation accept e.g factors out 3 from the relevant terms to achieve a form $3\times\left(n^2+n\right)+1$ which is one more than a multiple of 3, or explains each term other than 1 is divisible by 3