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GCSE MATHS

Algebra

Edexcel 1MA1 | Subtopic collection Topic 26

Composite and inverse functions

Higher tier

Answers and examiner comments

16	2017-2025	Higher
question groups	available papers	tier

Using this booklet

1. Answer numbers match the companion question booklet.
2. Follow the original question number on marking tables.
3. Examiner comments are included where available.

Name _____ **Date** _____

Some entries use full source marking material in an appendix. Any unavailable mark schemes are identified beside the relevant answer.

22		7, −1	P1	for strategy to use g(3) = 20, e.g. $3a + b = 20$
			P1	for g(1) = $a + b$
			P1	for a process to find inverse of f. e.g. $f^{-1}(x) = \frac{x-3}{5}$ or $f^{-1}(33) = 6$
			P1	for using $f^{-1}(33) = g(1)$ to find an equation e.g. $\frac{33-3}{5} = a + b$
			A1	for $a = 7$, $b = -1$

Paper: 1MA1/2H

11	(a)	$\frac{2}{25}$	B1	accept 0.08	
	(b)	$\frac{1}{8}$	M1	fg(x) = $\frac{2}{(4x^3)^2}$ oe **or** g(1) = 4 **or** $\frac{2}{(4\times1^3)^2}$ oe	
			A1	oe	All powers and products must be evaluated

19	(a)	shown	C1	for first step, eg $2((x + 1)^2 - 1)$ or $2(x^2 + 2x + 1 - 1)$ oe	
			C1	for fully correct chain of reasoning	It is insufficient to state $gf(x) = 2x(x + 2)$ without showing the first step, and the following sequence of algebraic steps leading to it.
	(b)	4.5	M1	process to find inverse of g, eg $g^{-1}(x) = \frac{1}{2}x + 1$ **or** for $2(x - 1) = 7$	Could be shown in the form of a flowchart, which must show inverse operations.
			A1	for 4.5 oe	

Paper: 1MA1/1H

Question	Answer	Mark	Mark scheme	Additional guidance
10 (a)	1.56	B1	1.56 to 1.563	
(b)	3.63	M1	for a complete method to find fg(34) eg 4 sin 65(=3.625..) **or** fg(x) eg 4 sin ($2x-3$)	
		A1	for answer in the range 3.6 to 3.63	If an answer in the range is seen in working and then incorrectly rounded award full marks.
(c)	Statement	C1	for statement eg positive and negative square root required. **Acceptable examples** The other answer is -9 The quadratic should have 2 solutions. **Not acceptable examples** He has not expanded the brackets. He needed to (x+4) twice as there is a squared sign. (x+4)^2 is 16 not 25. Didn't expand the bracket.	

21	(a)	$\frac{x+1}{3}$	M1	first step to change the subject of $y = 3x - 1$ **or** $x = 3y - 1$, eg $y + 1 = 3x$	
			A1	oe	
	(b)	Shown	M1	for method to find fg(x), eg fg(x) = $3(x^2 + 4) - 1$	
			M1	for method to find gf(x), eg gf(x) = $(3x - 1)^2 + 4$	
			M1	(dep on previous two M marks) for setting up equation, eg $3(x^2 + 4) - 1 = 2[(3x - 1)^2 + 4]$	
			M1	(dep 2nd M1) for correct expansion of $(3x - 1)^2$ eg $9x^2 - 3x - 3x + 1$	
			C1	for $15x^2 - 12x - 1 = 0$ from correct working	

Paper: 1MA1/1H

17	B, A, D, C	B2 (B1	for all correct for two or three correct)	

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
18 (a)	Shown	C1	for $f^{-1}(x) = \sqrt[3]{\frac{x+4}{2}}$ OR for $2x^3 - 4 = 50$ OR for substituting $x = 3$ to find f(3)	
		C1	for substituting $x = 50$ to show the result giving $f^{-1}(50) = 3$ OR solving for x to give $x = 3$ OR for showing that $f(3) = 50$	
(b)	$x = -1$ and $x = 2.5$	P1	for $hg(x) = (x + 2)^2$	
		P1	(dep) for start to a process to derive a quadratic equation eg. $x^2 + 4x + 4 = 3x^2 + x - 1$	$(x + 2)^2$ must be correctly expanded
		P1	for a process to solve the quadratic equation $2x^2 - 3x - 5 = 0$ eg $(2x - 5)(x + 1)$ (= 0) or $\frac{--3\pm\sqrt{(-3)^2-4\times2\times-5}}{2\times2}$ or $2\left[(x - \frac{3}{4})^2 - \frac{9}{16} - \frac{5}{2}\right]$ (= 0)	
		A1	for $x = -1$ and $x = 2.5$	2.5 or $2\frac{1}{2}$ or $\frac{5}{2}$ acceptable

Paper: 1MA1/1H

Question	Answer	Mark	Mark scheme	Additional guidance
19 (a)	33	B1	cao	
(b)	27	M1	for f(9) = 12 ÷ √9 (=4) **and** a clear intention to find g("4") **or** for $3\times(2\times\frac{12}{\sqrt{9}}+1)$ **or** for stating gf eg $3(2\times\frac{12}{\sqrt{x}}+1)$ oe	
		A1	cao	
(c)	$\frac{1}{2}$	M1	for g^{-1} as $\frac{x-3}{6}$ oe **or** for starting to solve $3(2x + 1) = 6$	Accept $\frac{y-3}{6}$
		A1	for $\frac{1}{2}$ oe	

Question	Answer	Mark	Mark scheme	Additional guidance
21 (a)	$\frac{1}{4}$	M1	for f(1) = 3 × 1^2 + 1 (= 4) **and** a clear intention to find g("4") **or** for $\frac{4}{\left(3\times1^2+1\right)^2}$ **or** for stating gf(x), eg $\frac{4}{\left(3x^2+1\right)^2}$ oe	
		A1	oe	
(b)	$\sqrt[4]{\frac{48}{x-1}}$	M1	for finding fg(x), eg $3\times\left(\frac{4}{x^2}\right)^2+1$ **or** $\frac{48}{x^4}+1$	
		M1	for start of method to find the inverse of fg(x), eg $y-1=3\times\left(\frac{4}{x^2}\right)^2$ **or** $y-1=\frac{48}{x^4}$ **or** $x-1=\frac{48}{y^4}$ **or** $x-1=3\times\left(\frac{4}{y^2}\right)^2$	
		M1	for $y^4=\frac{48}{x-1}$ **or** $x^4=\frac{48}{y-1}$ **or** for a final answer of $\sqrt[4]{\frac{48}{y-1}}$	
		A1	oe	

Paper: 1MA1/2H

Question	Answer	Mark	Mark scheme	Additional guidance
19 (a)	3	B1	cao	
(b)	$\frac{2}{x^3+5}$	M1	for finding $\left(g^{-1}(x)=\right)\frac{x^3+5}{2}$ oe	
		M1	for $\left(hg^{-1}(x)=\right)=\frac{1}{\left[g^{-1}(x)\right]}$ oe	$[g^{-1}(x)]$ must be their inverse function and cannot be $\sqrt[3]{2x-5}$
		A1	Accept $\left(\frac{x^3+5}{2}\right)^{-1}$	

22	$\frac{x^3 - 3}{2}$	M1 M1 A1	for $(h(x)) = \sqrt[3]{2x + 3}$ for a correct first step to find the inverse of [h(x)] oe	 [h(x)] must be their composite function and cannot be either $\sqrt[3]{x}$ or $2x + 3$

Paper: 1MA1/2H

20	(a)	$(5x-2)^2$	M1	for a first step to change the subject of $y=\frac{\sqrt{x}+2}{5}$ or $x=\frac{\sqrt{y}+2}{5}$, eg $5y=\sqrt{x}+2$ or $5x=\sqrt{y}+2$	
			A1	oe	
	(b)	55	M1	for method to find gf(x), eg $\frac{\sqrt{3x+4}+2}{5}$ **or** method to find $g^{-1}(3)$, eg $(5\times 3-2)^2$ (= 169)	
			M1	for method to solve as far as 2 steps away, eg $(5\times 3-2)^2=3x+4$ or $3x+4=$ "169" **or** for a complete method, eg ("169" – 4) ÷ 3	
			A1	cao	

Paper: 1MA1/1H

19	(a)	17	M1	For $\left(\text{gf}\left(x\right)=\right)2\left(2x+3\right)^2-1$ **or** $\left(\text{gf}\left(x\right)=\right)8x^2+24x+17$ **or** $2(2\times(-3)+3)^2-1$	Substitution may be seen in 2 steps
			A1	cao	
	(b)	$\frac{x+1}{2}$	M1	for a suitable first step, eg adds 1 to both sides, eg $y + 1 = 2x$ **or** $x + 1 = 2y$ **or** $g(x) + 1 = 2x$ **or** $x=\frac{y+1}{2}$	
			A1	oe	

Paper: 1MA1/2H

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	–6	B1	cao	
(b)	4	M1	for g(1) = 5 – 3 × 1 (= 2) **and** a clear intention to find f("2") **or** for $\frac{12}{5-3\times1+1}$ **or** for stating fg, eg $\frac{12}{5-3x+1}$ oe	For reference $f(x) = \frac{12}{x+1}$ and $g(x) = 5 - 3x$
		A1	cao	Accept $\frac{4}{1}$
(c)	$\frac{1}{3}$	M1	for g^{-1} as $\frac{5-x}{3}$ oe **or** for $5 - 3x = 4$ **or** $g\left(\frac{1}{3}\right) = 5 - 1 = 4$	Could be shown in the form of a flowchart, which must show correct inverse operations. Allow g^{-1} and g to be in terms of y ie accept $\frac{5-y}{3}$ and $5 - 3y = 4$
		A1	for $\frac{1}{3}$ oe eg 0.33(3…)	

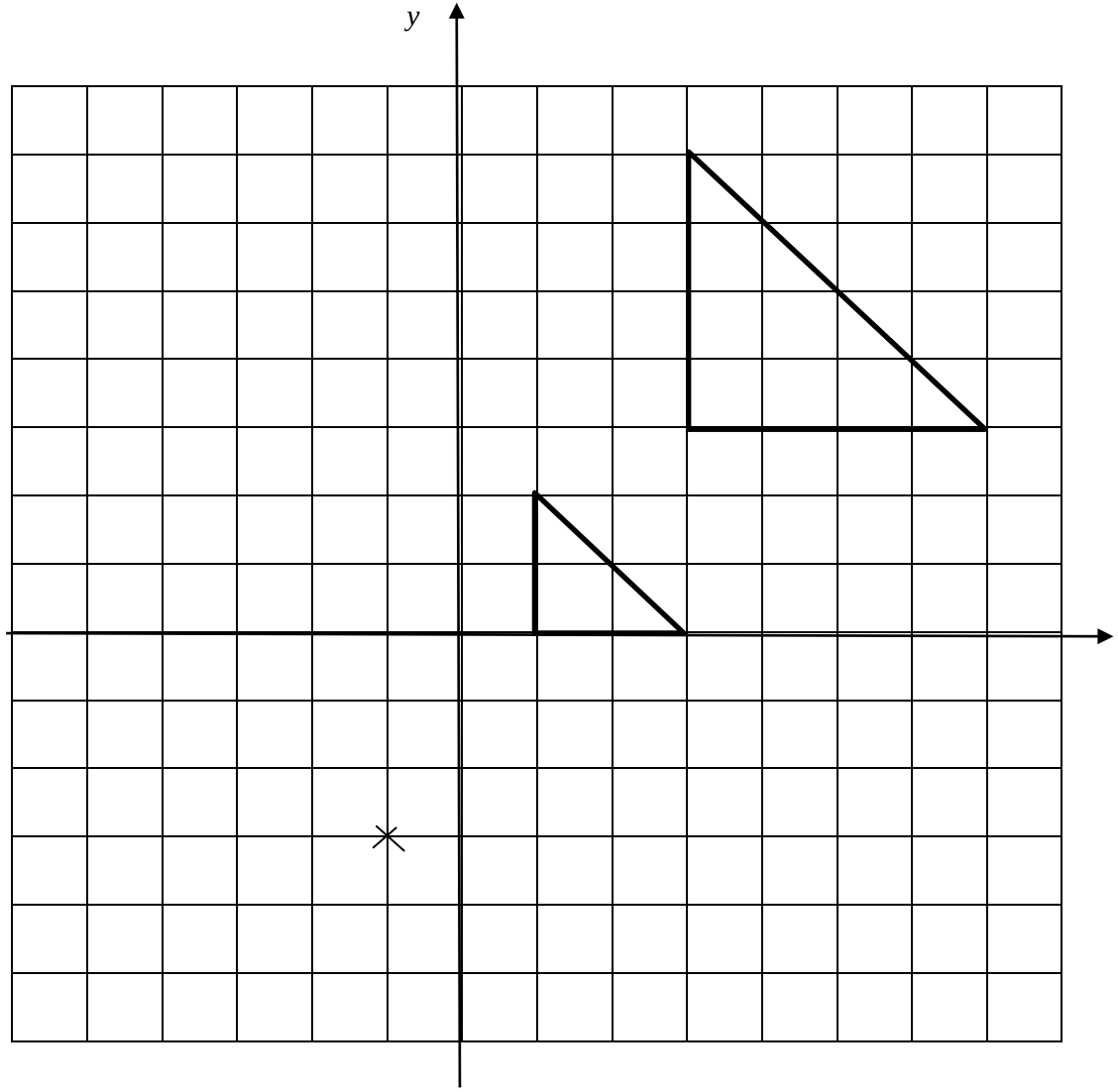
18	(a)	$\frac{4x+3}{5}$	M1	for first step to change the subject of $y=\frac{5x-3}{4}$ or $x=\frac{5y-3}{4}$ eg $4y=5x-3$ or $4x=5y-3$	Answer of $\frac{4y+3}{5}$ gets M1A0
			A1	oe	
	(b)	100	M1	for h(5) = 1 – 2 × 5 (= – 9) **and** a clear intention to find g("– 9") **or** for $((1-2\times5)-1)^2$ **or** for stating gh(x), eg $(1-2x-1)^2$ oe	
			A1	cao	

Paper: 1MA1/1H

Paper: 1MA1/1H

Question	Answer	Mark	Mark scheme	Additional guidance
17	Shown	M1	for method to finding gh(x), eg gh(x) = $1 - 3(2x^2 - 1)$	$= 1 - 6x^2 + 3$ $= 4 - 6x^2$
		M1	for method to find hg(x), eg hg(x) = $2(1 - 3x)^2 - 1$	$= 2(1 - 3x - 3x + 9x^2) - 1$ $= 2 - 12x + 18x^2 - 1$ $= 1 - 12x + 18x^2$
		M1	(dep M2) for method to find 3gh(x) + hg(x) eg $3(1 - 3(2x^2 - 1)) + 2(1 - 3x)^2 - 1$ (= 0)	Expressions for gh(x) and hg(x) may have been incorrectly expanded and simplified
		M1	for expanding all brackets as far as at least $3 - 18x^2 + 9 + 2 - 12x + 18x^2 - 1$ (= 0)	Need not be fully simplified but must be correct
		C1	for reducing to a linear equation eg $13 - 12x = 0$ and stating that this gives just one solution or stating $x = \frac{13}{12}$ oe	

Question 9(b)



Modifications to the mark scheme for Modified Large Print (MLP) papers: 1MA1 1H

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme. Notes apply to both MLP papers and Braille papers unless otherwise stated.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:
Angles: ±5°
Measurements of length: ±5 mm

PAPER: 1MA1_1H			
Question		**Modification**	**Mark scheme notes**
2		Wording added: Look at the table for Question 2 in the Diagram Booklet.	Standard mark scheme
3	(a)	Wording added: 'below'. Wording added: 'There are four spaces to fill.' Braille: Wording added 'by writing the missing values labelled (i) to (iv).' Table turned vertical.	Standard mark scheme
	(b)	Wording added: 'Look at the diagram for Question 3(b) in the Diagram Booklet. It shows a grid.' Diagram enlarged. Open headed arrows. Braille: Wording added 'Drawing film and bumpons are provided if you wish to use them.'	Standard mark scheme
6		Wording added: 'Look at the diagram for Question 6 in the Diagram Booklet.' Diagram enlarged.	Standard mark scheme
7		Letter x changed to p.	Standard mark scheme but note change of letter
8	 (b)	Wording changed: 'Look at the diagram for Question 8 in the Diagram Booklet. It shows right-angled triangle ABC.' Wording added: 'Angle ACB is a right angle.' Diagram enlarged. Open headed arrows. Horizontal list turned vertical.	Standard mark scheme

PAPER: 1MA1_1H			
Question		**Modification**	**Mark scheme notes**
9	(a)	Wording added: 'Look at the diagram for Question 9(a) in the Diagram Booklet. It shows shape A and shape B on a grid.' Wording added: 'An accurate cutout shape may be available if you wish to use it.' Diagram enlarged. Open headed arrows. Shapes labelled 'shape A' and 'shape B' Cutout shape provided.	Standard mark scheme
9	(b)	Wording added: 'Look at the diagram for Question 9(b) in the Diagram Booklet. It shows triangle A and triangle B on a grid.' Wording changed: 'Describe fully the single transformation that maps triangle A onto triangle B. Two accurate cutout shapes may be available if you wish to use them.' Diagram enlarged. Open headed arrows. Triangle A moved up by one square. Triangle B added. Shapes labelled 'triangle A' and 'triangle B' Horizontal axis cropped so it starts at -3. Two cutout shapes provided.	C2 for enlargement, scale factor $\frac{1}{2}$ oe , centre (–1, –2) (C1 for 2 of the 3 aspects) Award no marks if more than one transformation is given
11		Letter d changed to p.	Standard mark scheme but note change of letter
12		Wording changed: 'Look at the diagram for Question 12 in the Diagram Booklet. It is a graph showing…' Diagram enlarged (2 cm squares). Open headed arrows. Intermediates added on both axes. Braille: Diagram enlarged (3 cm squares) with no intermediates.	Standard mark scheme
15		Wording changed: 'Look at the diagram for Question 15 in the Diagram Booklet. It is a histogram giving information...' Diagram enlarged. Open headed arrows.	Standard mark scheme
16	(b)	Letters changed: 'a' to 'p' and 'b' to 'q'.	Standard mark scheme but note change of letters

Question 21

Students who knew about inverse functions usually answered part (a) by rearranging $y = 3x - 1$ to make x the subject or rearranging $x = 3y - 1$ to make y the subject. Some mistakes were made in the first step with $y = 3x - 1$ being followed by $y - 1 = 3x$ for example. Most of the students who made a correct first step went on to give a correct answer. Those who completed the rearrangement correctly sometimes gave the answer in terms of y and lost the accuracy mark. Some students found the inverse function by using a flow diagram but this approach appeared to be less successful. A common incorrect answer was $1/(3x - 1)$ because some students interpreted $f^{-1}(x)$ as $1/f(x)$, confusing the notation for inverse functions with the notation for a negative power.

Part (b) was very well answered considering that it is one of the more challenging questions on the paper. It was pleasing that many of the students who demonstrated knowledge of composite functions were able to give fully correct answers. Working was generally set out well when students understood what to do. A few otherwise correct solutions were spoilt by a final line that was not $15x^2 - 12x - 1 = 0$ and these gained 4 of the 5 marks. Most errors occurred in the simplification of $gf(x)$ or $2gf(x)$ and in working that was poorly set out. Incorrect terms in the expansion and simplification of $(3x - 1)^2 + 4$ were quite common. Sometimes only $(3x - 1)^2$ was multiplied by 2. If the composite functions were not labelled as $fg(x)$ and $gf(x)$ then this could be implied by the setting up of the equation $fg(x) = 2gf(x)$ or by multiplying the correct composite function by 2. If labelling was not seen or implied then the answer scored no marks. Students with little or no idea of composite functions interpreted $fg(x)$ as $f(x) \times g(x)$ or started with $15x^2 - 12x - 1 = 0$ and attempted to solve it.

Question 17

Matching the functions to the graphs in this question produced a good spread of marks with about a third of all students scoring each of the marks available. The graph of a trigonometrical function was identified correctly more frequently than the other graphs and the graphs showing one form of proportionality or another were the least well known.

Question 18

In part (a), only a very few students correctly found an algebraic expression for the inverse of f(x). The most successful approach was in showing f(3) = 50 but a great number of students found f(50) instead which was clearly incorrect. Notation was often poor with the cube root symbol not encompassing the whole expression in some cases.

Only a minority of students correctly quoted hg(x) = $(x + 2)^2$, in part (b), and were able to make any progress. The most common mistake was in substituting $x + 2$ into hg(x). Those who managed to substitute correctly and form an equation often failed to simplify and solve the resulting quadratic equation.

Question 19

Part (a) was answered quite well with many students knowing how to find g(5).

In part (b), the most popular approach to a correct answer was to find f(9) = 4 and then find g(4) although some students first found gf(x) and substituted $x = 9$. It was surprising to see $3(2\times4 + 1) = 24 + 1 = 25$ in a number of responses. Misunderstanding of composite functions was evident in many answers. In order to find gf(9) many students found both f(9) and g(9) and then multiplied them or added one to the other.

In part (c), students who knew about inverse functions usually found $g^{-1}(6)$ by first finding $g^{-1}(x)$. Incorrect expressions for $g^{-1}(x)$ were often the result of applying $\div 3$, -1 and $\div 2$ in the wrong order. Some students found $g^{-1}(6)$ by solving the equation $3(2x + 1) = 6$. A common incorrect answer was $\frac{1}{39}$ because $g^{-1}(6)$ was often interpreted as $1/g(6)$, the notation for inverse functions being confused with the notation for a negative power. Some students simply worked out $g(6)$ and gave 39 as the answer.

Question 21

In part (a), the most popular approach to a correct answer was to first find f(1) = 4 and then work out g(4) although some students first found gf(x) and then substituted $x = 1$. A surprising number of students could not evaluate $3\times1^2 + 1$ correctly and lost the accuracy mark. Misunderstanding of composite functions was evident in many answers and a common incorrect method was to find both f(1) and g(1) and then multiply the two results or add one to the other.

Part (b) was not well answered. Students with some knowledge of functions often gained the first mark for finding fg(x) but most then made little or no progress in finding the inverse function. Errors in algebraic manipulation frequently spoilt the attempts of those who did carry on and only a small number of students gave a fully correct answer.

Question 19

Part (a) was a simple substitution mark which many were able to score. Some students were put off by the function notation and didn't attempt the question.

In part (b) students were required to understand function notation clearly and realise in this case they needed to find the inverse of g(x) before then substituting that into h(x). This question posed a number of challenges. For many the notation alone was the stumbling block and they tried to put g(x) into h(x) and then find the inverse. Others struggled to find the required inverse function. However, these students were able to gain the second mark for correctly substituting their inverse function into h(x). A few of those who gained method marks, were then unable to gain the accuracy mark as they left it as a fraction within a fraction, rather than simplifying fully.

Question 22

This functions question required candidates to first find a composite function, and then to find the inverse function. A pleasing number of candidates were able to find the composite function. Those who were unsuccessful typically gave $\sqrt[3]{2x} + 3$ as their incorrect composite. However, the second mark here was not dependent upon the first, so providing a composite function was found (correct or not), the second mark could be awarded if the first step to find the inverse was correct. Again, a good number of candidates were able to get this mark.

Question 20

In part (a) the students who knew about inverse functions usually tried to find $g^{-1}(x)$ by rearranging $y = \frac{\sqrt{x}+2}{5}$ to make x the subject or rearranging $x = \frac{\sqrt{y}+2}{5}$ to make y the subject. Many got as far as $5y = \sqrt{x}+2$ or $5x = \sqrt{y}+2$ and gained the first mark. A good proportion of the students who made a correct first step went on to give a correct answer. Those who completed the rearrangement correctly sometimes gave the answer in terms of y and lost the accuracy mark. Some unwisely attempted to expand $(5x – 2)^2$ and if they did so incorrectly they lost the accuracy mark. A common error in the final step of the rearrangement was to follow $5y-2 = \sqrt{x}$ with $\sqrt{5y-2} = x$. Some students attempted to find the inverse function by using a flow diagram but this approach appeared to be less successful. Incorrect expressions for $g^{-1}(x)$ such as $5(x^2 – 2)$ or $5x^2 – 2$ were often the result of applying the inverse operations in the wrong order. Unfortunately, many students seemed unaware of the concept of an inverse function and some mistook the notation to mean the reciprocal.

In part (b), many students started by finding an expression for $gf(x)$ and gained the first mark. Instead of equating $gf(x)$ with 3 a common error was to substitute $x = 3$ into $gf(x)$ and students doing this gained no more marks. Those who did equate $gf(x)$ with 3 often went on to solve the equation and score full marks. Some students made mistakes when rearranging the equation and some made arithmetic errors when squaring 13 or when dividing 165 by 3, with 53 (from 165 ÷ 3) being a common incorrect answer.

Question 19

This was one of the better answered questions at this level, with a good number able to gain 2 marks in part (a). This was normally done by two steps of substitution, rather than forming the composite function. However, some that attempted the two steps of substitution, completed the first step correctly, but then instead of substituting their found value into g(x), they re-substituted −3, and unfortunately gained no credit.
In part (b) it was pleasing to see so many understand the concept of an inverse function, and many were able to rearrange to find this.

Question 16

Part (a) was well answered with the majority of students giving the correct answer of –6. In part (b) the most successful approach was to find g(1) and then substitute this answer into f(x). However many also found f(1) and then multiplied these two together. As this showed a lack of understanding of composite functions this did not gain the method mark. Less common was to find an expression for fg(x) and then to evaluate fg(1). This approach was rarely successful due to students having difficulty dealing with the –3x. Part (c) was not well answered with the most common error being to substitute $x = 4$ into $g(x)$ and some incorrectly interpreted $g^{-1}(x)$ as the reciprocal of $g(x)$. It was common for the students who recognised that they could proceed on this question by finding the inverse function but often made a sign error and so arrived at $\frac{x-5}{3}$ or equivalent which prevented them from gaining the method mark. Less students approached the problem by equating the $5 - 3x$ to 4 and solving for x but when this method was chosen, it was often done successfully.

Question 18

Those with some knowledge of inverse functions usually answered part (a) by rearranging $y = \frac{5x-3}{4}$ to make x the subject or rearranging $x = \frac{5y-3}{4}$ to make y the subject. A correct first step in the rearrangement earned the method mark. Many of the learners that made a correct

first step went on to give a correct answer but errors in the rearranging cost some the accuracy mark. Following $4x = 5y - 3$ with $4x - 3 = 5y$ was quite a common error. Some completed the rearrangement correctly but gave the answer in terms of y and lost the accuracy mark. A common incorrect answer was $\frac{4}{5x-3}$ because $f^{-1}(x)$ was interpreted by some as the reciprocal of $f(x)$.

In part (b), the most common approach used to work out the value of gh(5) was to work out $h(5) = -9$ and then work out $g(-9)$. A clear intention to substitute -9 correctly earned the method mark. A surprising number of learners made hard work of evaluating $(-9 - 1)^2$. It was common to see this being expanded to give four terms which frequently did not lead to an answer of 100 or to see $-10^2 = -100$ and these responses earned one mark only. Some found $gh(x) = (1 - 2x - 1)^2$, which earned the method mark, and then substituted $x = 5$. Misunderstanding of composite functions was evident in many answers. Many learners found both g(5) and h(5) and then multiplied them or added one to the other.

Question 17

It was pleasing that many of the responses that demonstrated knowledge of composite functions were able to score full marks for showing that $3gh(x) + hg(x) = 0$ has just one solution for x. Working was generally set out well when candidates understood what to do. Algebraic errors were the reason for many responses not getting full marks. Errors often occurred in the simplification of $1 – 3(2x^2 – 1)$ and incorrect terms in the expansion and simplification of $2(1 – 3x)^2 – 1$ were quite common. Some responses expanded $(1 – 3x)^2$ and multiplied by 2 but then forgot to subtract 1. The third mark for substituting into $3gh(x) + hg(x) = 0$ could still be awarded when $gh(x)$ and/or $hg(x)$ had been simplified incorrectly but correct algebra was needed for the final two marks to be awarded. Some responses incorrectly equated both $3gh(x)$ and $hg(x)$ to 0 and lost the mark that would have been gained by simply adding them. If the composite functions were not labelled as $gh(x)$ and $hg(x)$ then this could be implied by the setting up of the equation $3gh(x) + hg(x) = 0$ or by multiplying the correct composite function by 3. If labelling was not seen or implied then the answer scored no marks. In weaker responses $gh(x)$ and/or $hg(x)$ were often interpreted as multiplying $g(x)$ and $h(x)$ together.

Summary

Based on their performance on this paper, candidates should:

- practise their arithmetic skills, particularly division and operations with decimals
- take care when carrying out arithmetic operations and check that answers are sensible
- consider using exterior angles as an efficient way of solving problems involving regular polygons
- practise solving algebraic equations and inequalities with fractional coefficients
- practise algebraic and geometric proofs and ensure they understand what constitutes a proof
- ensure that functions and composite functions are labelled clearly