1.2 Pure: Algebra and Functions

EDEXCEL 9MA0 · Calculator allowed · about 225 minutes · Write-in edition

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Simplify $(3x^4)^2$.

(Total for Question 1 is 1 mark)

2 Solve $x^2 = 121$, giving both values of x.

(Total for Question 2 is 1 mark)

3 f(x) = 4x - 9. Find f(5).

(Total for Question 3 is 1 mark)

4 Simplify (3x + 15)/3.

(Total for Question 4 is 1 mark)

5 Simplify the following algebraic fractions, giving each answer in its simplest form. State any values of x for which the fractions are undefined.

(a) Simplify fully $(x^2 - 9)/(x^2 + x - 6)$. **(3)**

(b) Hence, or otherwise, simplify $(x^2 - 9)/(x^2 + x - 6) / ((2x - 4)/(x + 3))$, giving your answer as a single fraction in its simplest form. **(4)**

(Total for Question 5 is 7 marks)

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6 Solve the equation $x^2 - 7x + 10 = 0$.

(Total for Question 6 is 2 marks)

7 Simplify $\sqrt{75}$, giving your answer in the form $k\sqrt{3}$.

(Total for Question 7 is 1 mark)

8 Write down the value of $4^{-1/2}$.

(Total for Question 8 is 1 mark)

9 Simplify $(x^3)(x^6)/x^4$.

(Total for Question 9 is 1 mark)

10 $g(x) = x^2 + 3$, x is real. State the range of g.

(Total for Question 10 is 1 mark)

11 Functions f and g are defined by $f(x) = 2/(x - 1)$, x is real, x not equal to 1, and $g(x) = x^2 + 4$, x is real.

(a) State the range of g. **(1)**

(b) Find the value of fg(3). **(2)**

(c) Find $f^{-1}(x)$, the inverse function of f, stating its domain. **(4)**

(d) Show that $gf(x) \geq 4$ for all x in the domain of f, without finding an explicit expression for gf(x). **(2)**

(Total for Question 11 is 9 marks)

12 The function f is defined by $f(x) = (x - 3)^2 - 4$, x is real.

(a) State the coordinates of the turning point of the graph of $y = f(x)$, and hence state the range of f. **(2)**

(b) The function g is defined by $g(x) = f(x - 2) + 5$, x is real. Describe fully the two geometric transformations that map the graph of $y = f(x)$ onto the graph of $y = g(x)$, and hence state the coordinates of the turning point of $y = g(x)$. **(4)**

(c) Given that $h(x) = |f(x)|$, find the set of values of x for which $h(x) = f(x)$. **(3)**

(Total for Question 12 is 9 marks)

13 Express $10/\sqrt{5}$ in the form $k\sqrt{5}$, stating the value of k.

(Total for Question 13 is 2 marks)

14 Solve the inequality $3x^2 - 11x - 4 \leq 0$.

(Total for Question 14 is 3 marks)

15 Simplify fully $(x^2 - 16)/(x^2 - 2x - 8)$, stating any values of x for which the expression is undefined.

(Total for Question 15 is 3 marks)

16 Solve the equation $|3x - 4| = 11$.

(Total for Question 16 is 3 marks)

17 Find the set of values of x for which $x^2 + 3x - 10 > 0$.

(Total for Question 17 is 3 marks)

18 $h(x) = |2x + 5|$.

(a) State the coordinates of the vertex of the graph of $y = h(x)$, and the coordinates of the point where the graph crosses the y-axis. **(2)**

(b) Solve the equation $|2x + 5| = 3x - 1$. **(4)**

(c) Hence, or otherwise, solve the inequality $|2x + 5| \leq 3x - 1$. **(3)**

(Total for Question 18 is 9 marks)

19 Find the set of values of x for which $3x - 5 < 2x - 8$ and $x^2 + x - 20 > 0$.

(a) Solve the linear inequality. **(1)**

(b) Solve the quadratic inequality. **(2)**

(c) Hence find the set of values of x that satisfy both inequalities. **(2)**

(Total for Question 19 is 5 marks)

20 The equation $x^2 + 2kx + (8k - 7) = 0$, where k is a constant, is to be considered.

(a) Find the discriminant of the equation, simplifying fully. **(3)**

(b) Find the set of values of k for which the equation has two distinct real roots. **(3)**

(c) Find the value(s) of k for which the equation has equal roots, and find the repeated root in each case. **(3)**

(Total for Question 20 is 9 marks)

21 The line l has equation $y = -6x - 4$ and the curve C has equation $y = x^2 - 4x - 4$. The line meets the curve at the points A and B.

(a) Show that the x coordinates of A and B satisfy $x^2 + 2x = 0$. **(2)**

(b) Hence find the coordinates of A and B. **(3)**

(c) Find the exact length of AB. **(3)**

(Total for Question 21 is 8 marks)

22 Find the set of values of x for which $2x + 6 < 3x$ and $x^2 + 9x + 18 > 0$.

(a) Solve the linear inequality. **(2)**

(b) Solve the quadratic inequality. **(2)**

(c) Hence find the set of values of x that satisfy both inequalities. **(2)**

(Total for Question 22 is 6 marks)

23 The line l has equation $y = 7x - 15$ and the curve C has equation $y = x^2 - x - 3$. The line meets the curve at the points A and B.

(a) Show that the x coordinates of A and B satisfy $x^2 - 8x + 12 = 0$. **(2)**

(b) Hence find the coordinates of A and B. **(3)**

(c) Find the exact length of AB. **(3)**

(Total for Question 23 is 8 marks)

24 The equation $x^2 + 2kx + (-k + 2) = 0$, where k is a constant, is to be considered.

(a) Find the discriminant of the equation, simplifying fully. **(3)**

(b) Find the set of values of k for which the equation has two distinct real roots. **(3)**

(c) Find the value(s) of k for which the equation has equal roots, and find the repeated root in each case. **(3)**

(Total for Question 24 is 9 marks)

25 $f(x) = x^3 + px^2 - 25x + 50$, where p is a constant. $(x + 5)$ is a factor of $f(x)$.

(a) Show that $p = -2$. **(3)**

(b) Factorise $f(x)$ completely. **(3)**

(c) Find the remainder when $f(x)$ is divided by $(x + 2)$. **(2)**

(Total for Question 25 is 8 marks)

26 The equation $x^2 + 2kx + (k + 6) = 0$, where k is a constant, is to be considered.

(a) Find the discriminant of the equation, simplifying fully. **(3)**

(b) Find the set of values of k for which the equation has two distinct real roots. **(3)**

(c) Find the value(s) of k for which the equation has equal roots, and find the repeated root in each case. **(3)**

(Total for Question 26 is 9 marks)

27 $f(x) = x^3 + px^2 - 4x - 16$, where p is a constant. $(x + 4)$ is a factor of $f(x)$.

(a) Show that $p = 4$. **(3)**

(b) Factorise $f(x)$ completely. **(3)**

(c) Find the remainder when $f(x)$ is divided by $(x - 4)$. **(2)**

(Total for Question 27 is 8 marks)

28 Prove each of the following results using an appropriate method of proof.

(a) Prove that $x^2 - 6x + 11 > 0$ for all real values of x. **(3)**

(b) Prove, by contradiction, that there is no smallest positive rational number. **(3)**

(Total for Question 28 is 6 marks)

29 A line l has equation $y = 3x - 2$. A curve C has equation $y = x^2 + x - 4$. The line l intersects the curve C at the points A and B.

(a) Show that the x-coordinates of A and B satisfy the equation $x^2 - 2x - 2 = 0$. **(2)**

(b) Hence find the coordinates of A and B, giving your answers in exact (surd) form. **(5)**

(c) The line l is translated to give the line l' with equation $y = 3x + k$. Find the range of values of k for which l' does not intersect C. **(4)**

(Total for Question 29 is 11 marks)

30 $f(x) = 2x^3 + x^2 - 13x + 6$.

(a) Use the factor theorem to show that $(x - 2)$ is a factor of $f(x)$. **(2)**

(b) Hence factorise $f(x)$ completely. **(4)**

(c) Solve $f(x) = 0$, and hence find the set of values of x for which $f(x) > 0$. **(4)**

(Total for Question 30 is 10 marks)

31 The curve C has equation $y = x^2 - 4x + 1$. The line l has equation $y = 2x - 7$. Find the coordinates of the point(s) where l intersects C.

(Total for Question 31 is 4 marks)

32 $(2x^2 - 3x + 4)/((x-2)^2(x+1)) = A/(x-2) + B/(x-2)^2 + C/(x+1)$

(a) Find the values of the constants A, B and C. **(6)**

(b) Express $(9x + 1)/((x-3)(2x+1))$ in the form $A/(x-3) + B/(2x+1)$, finding integer values of A and B. **(4)**

(Total for Question 32 is 10 marks)

33 The function f is defined by $f(x) = (3x + 2)/(x - 3)$, x is real, x not equal to 3.

(a) Find $f^{-1}(x)$ algebraically, and show that $f^{-1}(x) = f(x)$ for all x in the domain of f. **(5)**

(b) Hence write down the value of ff(4). **(1)**

(c) Solve the equation $f(x) = x$, giving your answers in exact (surd) form. **(4)**

(Total for Question 33 is 10 marks)

Mark scheme · 1.2 Pure: Algebra and Functions

Question 1

$9x^8$ cao **B1**

Answer: $9x^8$

Question 2

x = 11 or x = -11, both values cao **B1**

Answer: x = 11 or x = -11

Question 3

11 cao **B1**

Answer: 11

Question 4

x + 5 cao **B1**

Answer: x + 5

Question 5

(a) factorises numerator as (x-3)(x+3) **M1**

(a) factorises denominator as (x+3)(x-2) **M1**

(a) (x-3)/(x-2) cao, x not equal to -3, 2 **A1**

(a) Answer: (x - 3)/(x - 2), x not equal to -3 or 2

(b) rewrites division as multiplication by the reciprocal (x+3)/(2x-4) **M1**

(b) uses result of part (a) and factorises 2x - 4 as 2(x-2) **M1**

(b) correct combined fraction $(x-3)(x+3)/[2(x-2)^2]$ **A1**

(b) $(x^2 - 9)/(2(x-2)^2)$ oe (e.g. $(x-3)(x+3)/(2(x-2)^2)$), fully simplified, cao **A1**

(b) Answer: $(x^2 - 9)/(2(x - 2)^2)$

Question 6

factorises (x - 2)(x - 5) **M1**

x = 2 or x = 5 cao **A1**

Answer: x = 2 or x = 5

Question 7

$5\sqrt{3}$ cao **B1**

Answer: $5\sqrt{3}$

Question 8

1/2 cao **B1**

Answer: 1/2

Question 9

x^5 cao **B1**

Answer: x^5

Question 10

g(x) ≥ 3 oe **B1**

Answer: g(x) ≥ 3

Question 11

(a) g(x) ≥ 4 oe **B1**

(a) Answer: g(x) ≥ 4

(b) finds g(3) = 13 **M1**

(b) fg(3) = 1/6 cao **A1**

(b) Answer: 1/6

(c) sets y = 2/(x-1) and attempts to make x the subject, e.g. y(x-1) = 2 **M1**

(c) correctly isolates x, x = 1 + 2/y **dM1**

(c) $f^{-1}(x) = 1 + 2/x$ oe cao **A1**

(c) domain x not equal to 0 (ft from range of f) **B1ft**

(c) Answer: $f^{-1}(x) = 1 + 2/x$, x not equal to 0

(d) recognises that $g(t) = t^2 + 4 \geq 4$ for any real number t, since $t^2 \geq 0$ **B1**

(d) correct conclusion: since f(x) is real for all x not equal to 1, gf(x) = g(f(x)) ≥ 4 for all such x, cso **B1**

(d) Answer: gf(x) ≥ 4 for all x not equal to 1 (shown)

Question 12

(a) turning point (3, -4) **B1**

(a) range f(x) ≥ -4 (ft from turning point) **B1ft**

(a) Answer: turning point (3, -4); range f(x) ≥ -4

(b) translation by vector (2, 0), i.e. 2 units in the positive x-direction **B1**

(b) translation by vector (0, 5), i.e. 5 units in the positive y-direction **B1**

(b) both transformations correctly described together (order not required to be justified) **B1**

(b) turning point of g is (5, 1) (ft from part a translated correctly) **A1ft**

(b) Answer: translations (2,0) then (0,5); turning point of g is (5, 1)

(c) recognises h(x) = f(x) requires f(x) ≥ 0 **M1**

(c) solves $(x-3)^2 \geq 4$ correctly, e.g. x - 3 ≤ -2 or x - 3 ≥ 2 **M1**

(c) x ≤ 1 or x ≥ 5 cao **A1**

(c) Answer: x ≤ 1 or x ≥ 5

Question 13

multiplies numerator and denominator by $\sqrt{5}$ **M1**

$2\sqrt{5}$, i.e. k = 2 cao **A1**

Answer: $10/\sqrt{5} = 2\sqrt{5}$, k = 2

Question 14

factorises $3x^2 - 11x - 4$ as (3x + 1)(x - 4) **M1**

critical values x = -1/3 and x = 4 **A1**

-1/3 ≤ x ≤ 4 cao, correct inequality direction **A1**

Answer: -1/3 ≤ x ≤ 4

Question 15

factorises numerator as (x - 4)(x + 4) **M1**

factorises denominator as (x - 4)(x + 2) **M1**

(x + 4)/(x + 2) cao, x not equal to 4 or -2 **A1**

Answer: (x + 4)/(x + 2), x not equal to 4 or -2

Question 16

sets up two linear equations $3x - 4 = 11$ and $3x - 4 = -11$ **M1**

$x = 5$ **A1**

$x = -7/3$ **A1**

Answer: x = 5 or x = -7/3

Question 17

factorises $x^2 + 3x - 10$ as $(x + 5)(x - 2)$ **M1**

critical values $x = -5$ and $x = 2$ **A1**

$x < -5$ or $x > 2$ cao **A1**

Answer: x < -5 or x > 2

Question 18

(a) vertex (-2.5, 0) oe **B1**

(a) y-intercept (0, 5) **B1**

(a) Answer: vertex (-2.5, 0); y-intercept (0, 5)

(b) squares both sides (or considers two linear cases) **M1**

(b) forms correct quadratic $5x^2 - 26x - 24 = 0$ (or equivalent pair of linear equations) **M1**

(b) $x = 6$ and $x = -0.8$ found **A1**

(b) rejects $x = -0.8$ since $3x-1 < 0$ there (invalid as LHS is non-negative); $x = 6$ only, cao **A1**

(b) Answer: x = 6 (only valid solution)

(c) considers the two cases $x \geq -2.5$ and $x < -2.5$ separately **M1**

(c) $x \geq 6$ obtained from the case $x \geq -2.5$ **A1**

(c) correctly justifies no solutions arise from the case $x < -2.5$ (consistent with rejected root in part b) **B1**

(c) Answer: x ≥ 6

Question 19

(a) $x < -3$ **B1**

(a) Answer: x < -3

(b) factorises $(x + 5)(x - 4)$ with critical values -5 and 4 **M1**

(b) $x < -5$ or $x > 4$ **A1**

(b) Answer: x < -5 or x > 4

(c) combines the two solution sets (a number line or sketch) **M1**

(c) $x < -5$ **A1**

(c) Answer: x < -5

Question 20

(a) uses $b^2 - 4ac$ with $a = 1$, $b = 2k$ **M1**

(a) $4k^2 - 4(8k - 7)$ **A1**

(a) $= 4(k^2 - 8k + 7)$ **A1**

(a) Answer: discriminant = 4(k - 1)(k - 7)

(b) discriminant > 0 and finds the critical values $k = 1$ and $k = 7$ **M1**

(b) chooses the outside region for a positive quadratic in k **M1**

(b) $k < 1$ or $k > 7$ **A1**

(b) Answer: k < 1 or k > 7

(c) sets the discriminant to zero **M1**

(c) $k = 1$ or $k = 7$ **A1**

(c) repeated root $x = -k$, so $x = -1$ or $x = -7$ **A1**

(c) Answer: k = 1, x = -1; k = 7, x = -7

Question 21

(a) equates the two expressions for y **M1**

(a) rearranges to $x^2 + 2x = 0$ (cso) **A1**

(a) Answer: $x^2 + 2x = 0$

(b) solves the quadratic by factorising or the formula **M1**

(b) $x = -2$ and $x = 0$ **A1**

(b) y values 8 and -4, giving (-2, 8) and (0, -4) **A1**

(b) Answer: A(-2, 8), B(0, -4)

(c) uses the distance formula **M1**

(c) $AB^2 = 4 + 144 = 148$ **M1**

(c) $AB = 2\sqrt{37}$ **A1**

(c) Answer: $AB = 2\sqrt{37}$

Question 22

(a) collects x terms: $-x < -6$ **M1**

(a) $x > 6$ **A1**

(a) Answer: x > 6

(b) factorises $(x + 6)(x + 3)$ with critical values -6 and -3 **M1**

(b) $x < -6$ or $x > -3$ **A1**

(b) Answer: x < -6 or x > -3

(c) combines the two solution sets (a number line or sketch) **M1**

(c) $x > 6$ **A1**

(c) Answer: x > 6

Question 23

(a) equates the two expressions for y **M1**

(a) rearranges to $x^2 - 8x + 12 = 0$ (cso) **A1**

(a) Answer: $x^2 - 8x + 12 = 0$

(b) solves the quadratic by factorising or the formula **M1**

(b) $x = 2$ and $x = 6$ **A1**

(b) y values -1 and 27, giving (2, -1) and (6, 27) **A1**

(b) Answer: A(2, -1), B(6, 27)

(c) uses the distance formula **M1**

(c) $AB^2 = 16 + 784 = 800$ **M1**

(c) $AB = 20\sqrt{2}$ **A1**

(c) Answer: $AB = 20\sqrt{2}$

Question 24

(a) uses $b^2 - 4ac$ with $a = 1$, $b = 2k$ **M1**

(a) $4k^2 - 4(-k + 2)$ **A1**

(a) $= 4(k^2 + k - 2)$ **A1**

(a) Answer: discriminant = 4(k + 2)(k - 1)

(b) discriminant > 0 and finds the critical values $k = -2$ and $k = 1$ **M1**

(b) chooses the outside region for a positive quadratic in k **M1**

(b) $k < -2$ or $k > 1$ **A1**

(b) Answer: k < -2 or k > 1

(c) sets the discriminant to zero **M1**

(c) $k = -2$ or $k = 1$ **A1**

(c) repeated root $x = -k$, so $x = 2$ or $x = -1$ **A1**

(c) Answer: k = -2, x = 2; k = 1, x = -1

Question 25

(a) uses the factor theorem: f(-5) = 0 **M1**

(a) $(-5)^3 + p(-5)^2 + (-25)(-5) + (50) = 0$ or equivalent **A1**

(a) solves 25p = -50 to obtain p = -2 (cso) **A1**

(a) Answer: p = -2

(b) divides f(x) by (x + 5) or equivalent to find a quadratic factor **M1**

(b) quadratic factor $x^2 - 7x + 10$ **A1**

(b) f(x) = (x - 2)(x - 5)(x + 5) **A1**

(b) Answer: f(x) = (x - 2)(x - 5)(x + 5)

(c) evaluates f(-2) **M1**

(c) remainder = 84 **A1**

(c) Answer: remainder = 84

Question 26

(a) uses $b^2 - 4ac$ with a = 1, b = 2k **M1**

(a) $4k^2 - 4(k + 6)$ **A1**

(a) = $4(k^2 - k - 6)$ **A1**

(a) Answer: discriminant = 4(k + 2)(k - 3)

(b) discriminant > 0 and finds the critical values k = -2 and k = 3 **M1**

(b) chooses the outside region for a positive quadratic in k **M1**

(b) k < -2 or k > 3 **A1**

(b) Answer: k < -2 or k > 3

(c) sets the discriminant to zero **M1**

(c) k = -2 or k = 3 **A1**

(c) repeated root x = -k, so x = 2 or x = -3 **A1**

(c) Answer: k = -2, x = 2; k = 3, x = -3

Question 27

(a) uses the factor theorem: f(-4) = 0 **M1**

(a) $(-4)^3 + p(-4)^2 + (-4)(-4) + (-16) = 0$ or equivalent **A1**

(a) solves 16p = 64 to obtain p = 4 (cso) **A1**

(a) Answer: p = 4

(b) divides f(x) by (x + 4) or equivalent to find a quadratic factor **M1**

(b) quadratic factor $x^2 - 4$ **A1**

(b) f(x) = (x + 2)(x + 4)(x - 2) **A1**

(b) Answer: f(x) = (x + 2)(x + 4)(x - 2)

(c) evaluates f(4) **M1**

(c) remainder = 96 **A1**

(c) Answer: remainder = 96

Question 28

(a) completes the square: $(x - 3)^2 + 2$ **M1**

(a) correct completed square form $(x-3)^2 + 2$ **A1**

(a) valid conclusion: $(x-3)^2 \geq 0$ for all real x, so expression $\geq 2 > 0$, cso **A1**

(a) Answer: $x^2 - 6x + 11 = (x-3)^2 + 2 \geq 2 > 0$ (proved)

(b) states the assumption for contradiction: suppose q is the smallest positive rational number **M1**

(b) constructs a valid smaller positive rational, e.g. q/2, and justifies it is rational and positive **M1**

(b) correct contradiction stated: q/2 < q contradicts q being smallest, so no smallest positive rational exists, cso **A1**

(b) Answer: no smallest positive rational number exists (proved by contradiction)

Question 29

(a) sets $x^2 + x - 4 = 3x - 2$ **M1**

(a) correctly rearranges to $x^2 - 2x - 2 = 0$, cso, answer printed **A1**

(a) Answer: $x^2 - 2x - 2 = 0$ (shown)

(b) correct use of the quadratic formula (or completing the square) with a=1, b=-2, c=-2 **M1**

(b) $x = 1 + \sqrt{3}$ and $x = 1 - \sqrt{3}$ oe, simplified **A1**

(b) substitutes an x-value into y = 3x - 2 (or into C) to find corresponding y **M1**

(b) $y = 1 + 3\sqrt{3}$ and $y = 1 - 3\sqrt{3}$, both correct **A1**

(b) both coordinates correctly stated as ordered pairs: $(1+\sqrt{3}, 1+3\sqrt{3})$ and $(1-\sqrt{3}, 1-3\sqrt{3})$ **A1**

(b) Answer: A = $(1 + \sqrt{3}, 1 + 3\sqrt{3})$, B = $(1 - \sqrt{3}, 1 - 3\sqrt{3})$

(c) sets $x^2 + x - 4 = 3x + k$ and rearranges to a 3-term quadratic equal to zero **M1**

(c) writes correct discriminant expression, e.g. 4 - 4(1)(-4-k) **M1**

(c) sets discriminant < 0 and attempts to solve the resulting inequality in k **M1**

(c) k < -5 cao **A1**

(c) Answer: k < -5

Question 30

(a) substitutes x = 2 into f(x) **M1**

(a) f(2) = 0, so (x-2) is a factor, cso **A1**

(a) Answer: f(2) = 0, so (x-2) is a factor (shown)

(b) divides f(x) by (x-2), or compares coefficients, to obtain quadratic factor $2x^2 + 5x - 3$ **M1**

(b) correct quadratic factor $2x^2 + 5x - 3$ **A1**

(b) factorises the quadratic factor **M1**

(b) f(x) = (x-2)(2x-1)(x+3) cao, fully factorised **A1**

(b) Answer: f(x) = (x - 2)(2x - 1)(x + 3)

(c) roots x = -3, x = 1/2, x = 2 identified **B1**

(c) considers the sign of f(x) in each of the four regions determined by the roots **M1**

(c) -3 < x < 1/2 identified as part of the solution set **A1**

(c) x > 2 identified, giving full solution -3 < x < 1/2 or x > 2, oe **A1**

(c) Answer: -3 < x < 1/2 or x > 2

Question 31

sets $x^2 - 4x + 1 = 2x - 7$ **M1**

rearranges to $x^2 - 6x + 8 = 0$ **M1**

x = 2 and x = 4 (factorises or uses the quadratic formula) **A1**

coordinates (2, -3) and (4, 1), both correct **A1**

Answer: (2, -3) and (4, 1)

Question 32

(a) sets up correct identity $2x^2-3x+4 = A(x-2)(x+1) + B(x+1) + C(x-2)^2$ **M1**

(a) substitutes x = 2 into the identity **M1**

(a) B = 2 **A1**

(a) substitutes x = -1 into the identity **M1**

(a) C = 1 **A1**

(a) A = 1, found by comparing coefficients or a further substitution, cao **A1**

(a) Answer: A = 1, B = 2, C = 1

(b) sets up correct identity 9x + 1 = A(2x+1) + B(x-3) **M1**

(b) substitutes a suitable value, e.g. x = 3 or x = -1/2 **M1**

(b) A = 4 **A1**

(b) B = 1 **A1**

(b) Answer: A = 4, B = 1

Question 33

(a) sets y = (3x+2)/(x-3) and cross-multiplies: y(x-3) = 3x+2 **M1**

(a) collects x terms on one side: x(y-3) = 3y+2 **M1**

(a) x = (3y+2)/(y-3) **A1**

(a) $f^{-1}(x) = (3x+2)/(x-3)$ **A1**

(a) states this is identical to f(x), so f is self-inverse, cso **A1**

(a) Answer: $f^{-1}(x) = (3x+2)/(x-3) = f(x)$, so f is self-inverse (shown)

(b) ff(4) = 4, using the self-inverse property (ft from part a) **B1ft**

(b) Answer: 4

(c) sets up equation (3x+2)/(x-3) = x and cross-multiplies **M1**

(c) rearranges to a 3-term quadratic equal to zero: $x^2 - 6x - 2 = 0$ **M1**

(c) correct use of the quadratic formula (or completing the square) **M1**

(c) $x = 3 + \sqrt{11}$ or $x = 3 - \sqrt{11}$, both values, simplified, oe **A1**

(c) Answer: $x = 3 + \sqrt{11}$ or $x = 3 - \sqrt{11}$