SOLVING EQUATION

Pearson Edexcel - Monday 12 November 2018 - Paper 3 (Calculator) Higher Tier

1.

13	408	M1	for 1.01 × 400 (= 404) or 408.04 or 412.08	412(.08) on the answer line M1A0
		A1	cao	1.01 × 400 may be seen as part of a calculation

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2.

14	Evidence of solution	M1	for constructing an equation eg $y \propto \frac{1}{x^3}$ or eg $y = \frac{k}{x^3}$ oe	
		M1	for substituting in the values a and 44 into $y = \frac{k}{x^3}$	
		C1	for a complete method to use the equation, the value of k and $x = 2a$ to show $y = 5.5$ eg $(2a)^3 y = 44a^3$ and $y = 44a^3 \div 8a^3 = 5.5$	Must show all steps clearly

Pearson Edexcel - Thursday 2 November 2017 - Paper 1 (Non-Calculator) Higher Tier

3.

6		Shows reasoning to reach $y=3$	M1	forms equation eg $2x + 6 = 5x - 9$	48÷3 (=16)	3(2x + 6) = 48 **or** 3(5x − 9) = 48, condone missing bracket
			M1	isolates x and number terms $3x = 15$	forms equation 2x+6="16" **or** 5x − 9= "16"	Isolates x and number terms 6x = "30" **or** 15x = "75"
			M1	substitutes "5" into side length eg $2 \times 5 + 6$ (=16)	isolates x and number terms 2x= "10" **or** 5x = "25"	forms the second equation
			A1	48÷16=3 **or** 16×3=48	shows x=5 for both solutions	x=5 from 2 different equations.

Pearson Edexcel - Monday 6 November 2017 - Paper 2 (Calculator) Higher Tier

4.

1		$1\frac{1}{2}$	M1	for correct expansion of the bracket or dividing all terms by 3 as a first step eg $3x - 3$ or $(5x - 6)/3 = 3(x - 1)/3$
			M1	for isolating terms in x on one side of an equation eg $5x - 6 - 3x = -3$ or both constants on one side of an equation, eg $5x = 3x - 3 + 6$, ft $5x - 6 = 3x - 1$
			A1	for $1\frac{1}{2}$ oe

Pearson Edexcel - Wednesday 8 November 2017 - Paper 3 (Calculator) Higher Tier

5.

15	(a)		Shown	M1	for method to establish at least one root between $x = 0$ and $x = 1$, eg f$(0) = -5$ and f$(1) = 3$
				C1	for correct values and a deduction about the roots eg as there is a sign change there must be at least one root between $x = 0$ and $x = 1$ (as f is continuous)
	(b)		Shown	C1	for a correct first step in rearrangement, eg $x(x^2 + 7) - 5 = 0$ or $x^3 + 7x = 5$
				C1	for clear and correct steps showing complete rearrangement
	(c)	$x_1 = 0.625$ $x_2 = 0.6765327696$ $x_3 = 0.6704483001$	0.6704(483001)	M1 M1 A1	for substitution of 1 into the formula (to get 0.625) for substitution of "$x_1 = 0.625$" and "$x_2 = 0.6765327696$" to give x_2 and x_3 0.6704(483001)
	(d)		Comment	M1 C1	substitutes answer to (c) into expression (to get $-0.00549...$) appropriate comment, eg accurate as answer is close to 0

Pearson Edexcel - Specimen Papers Set 2 - Paper 1 (Non-Calculator) Higher Tier

6.

10			9	M1	Finds constant 36×1.5 (=54) or $\frac{6}{1.5}$=4
				M1	$54 \div 6$ or $36 \div 4$
				A1	9 cao

Pearson Edexcel - Specimen Papers Set 2 - Paper 2 (Calculator) Higher Tier

7.

8	(a)		explanation	C1	for "incorrect expansion of brackets" oe
	(b)		explanation	C1	for "has not obtained both solutions" oe

Pearson Edexcel - Specimen Papers Set 1 - Paper 1 (Non-Calculator) Higher Tier

8.

14			$\frac{-2}{13}$	M1	multiplies all terms by 2 or 3 to reconcile fractions as first step
				M1	complete process of expanding brackets and isolating x term
				A1	cao

Pearson Edexcel - Sample Paper 1 - (Non-Calculator) Higher Tier

9.

8			$x = 21$, $y = 50$	P1	process to start solving problem eg. form an appropriate equation
				P1	complete process to isolate terms in x
				A1	for $x = 21$
				P1	complete process to find second variable
				A1	$y = 50$

Pearson Edexcel - Sample Paper 3 - (Calculator) Higher Tier

10.

11	$x = \dfrac{--5 \pm \sqrt{(-5)^2 - 4 \times 1 \times 3}}{2} =$ $\dfrac{5 \pm \sqrt{13}}{2}$	4.30 or 0.697	M1	Substitute into quadratic formula - allow sign errors
			M1	Evaluate as far as $\dfrac{5 \pm \sqrt{13}}{2}$
			A1	

Pearson Edexcel - Sample Paper 3 - (Calculator) Higher Tier

11.

14	(a)	$F(x) = x^3 + 4x - 1$ $F(0) = -1$, $F(1) = 4$	Shown	M1	Method to establish at least one root in [0,1] e.g $x^3 + 4x - 1$ ($=0$) and $F(0)(= -1)$, $F(1)$ ($= 4$) oe
				A1	Since there is a sign change there must be at least one root in $0 < x < 1$ (as F is continuous)
	(b)	$4x = 1 - x^3$ Or $\dfrac{x^3}{4} + x = \dfrac{1}{4}$	Shown	C1	C1 for at least one correct step and no incorrect ones
	(c)	$x_1 = \dfrac{1}{4} - \dfrac{0}{4} = \dfrac{1}{4}$ $x_2 = \dfrac{1}{4} - \dfrac{\left(\tfrac{1}{4}\right)^3}{4} = \dfrac{1}{4} - \dfrac{1}{256}$	0.246(09375) Or $\dfrac{63}{256}$	B1 M1 A1	$x_1 = \dfrac{1}{4}$ M1 for $x_2 = \dfrac{1}{4} - \dfrac{'\left(\tfrac{1}{4}\right)^3}{4}$ A1 for 0.246(09375) or $\dfrac{63}{256}$ oe

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12.

22			2, 6	3	M1 for $(x^2 =)$ $4(x^2 - 6x + 9)$ or $4x^2 - 24x + 36$ oe
					or for $\dfrac{x^2}{4} = x^2 - 6x + 9$
					M1 (dep) for $3x^2 - 24x + 36 = 0$ or $3(x^2 - 8x + 12) = 0$ or $(x - 2)(x - 6) = 0$ or $(3x - 6)(x - 6) = 0$ oe
					A1 cao
					OR
					M1 for $x = (\pm)2(x - 3)$ or $\dfrac{x}{2} = (\pm)(x - 3)$
					M1(dep) for correct solution of one equation
					A1 cao

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13.

20		$\dfrac{-6 \pm \sqrt{6^2 - 4 \times 3 \times -2}}{2 \times 3}$ $(x + 1)^2 - 1 - \dfrac{2}{3} = 0$	0.29 and −2.29	3	M1 for substitution of $a = 3$, $b = 6$, $c = -2$ into the formula or for completing the square (condone **one** sign error)
					M1 for $\dfrac{-6 \pm \sqrt{60}}{6}$ or $-1 \pm \sqrt{\dfrac{5}{3}}$ or in simplified form
					A1 for answers in the range 0.29 to 0.292 and −2.292 to −2.29

Pearson Edexcel - Thursday 4 June 2015 - Paper 1 (Non-Calculator) Higher Tier

14.

19	(a)		Proof	3	M1 for $\dfrac{6}{n}$ or $\dfrac{5}{n-1}$ M1 for $\dfrac{6}{n} \times \dfrac{5}{n-1} \left(= \dfrac{1}{3}\right)$ A1 for fully correct algebra leading to $n^2 - n - 90 = 0$
	(b)		10	3	M1 for correct start to a solution, eg. $(n \pm 10)(n \pm 9)$ or substitution into the quadratic formula, condoning one sign error or $(n - 0.5)^2 - 0.25 - 90$ A1 for $(n - 10)(n + 9)$ or for 10 and –9 or $\dfrac{1 \mp 19}{2}$ oe A1 for 10 only

Pearson Edexcel - Monday 8 June 2015 - Paper 2 (Calculator) Higher Tier

15.

25		$\dfrac{-4 \pm \sqrt{4^2 - 4 \times 3 \times -12}}{2 \times 3}$	1.44 and −2.77	3	M1 for substitution of $a = 3$, $b = 4$, $c = -12$ into the formula (condone one sign error) or for completing the square M1 for $\dfrac{-4 \pm \sqrt{160}}{6}$ or in simplified form A1 for answers in the ranges 1.43 to1.45 and −2.76 to −2.78

Pearson Edexcel - Friday 7 November 2014 - Paper 2 (Calculator) Higher Tier

16.

20			1.85 and − 0.180	3	M1 for $\dfrac{--5 \pm \sqrt{-5^2 - 4 \times 3 \times -1}}{2 \times 3}$ (condone one sign error) M1 for $\dfrac{5 \pm \sqrt{37}}{6}$ (=1.8 to1.85 or −0.18 to −0.181) A1 for answers in the ranges 1.8 to1.85, and −0.18 to −0.181

Pearson Edexcel - Friday 14 June 2013 - Paper 2 (Calculator) Higher Tier

17.

12	(a)	$3x - 6 = x + 7$ $2x = 13$	6.5	3	M1 for $3 \times x - 3 \times 2 \ (=3x - 6)$ or $\dfrac{x}{3} + \dfrac{7}{3}$ seen M1 for correct method to isolate the terms in x or the number terms on opposite sides of an equation A1 for 6.5 oe
	(b)	$2 - y = 1 \times 5$	− 3	2	M1 for intention to multiply both sides by 5 (to give 2 $-y = 1 \times 5$) A1 cao

Pearson Edexcel - Thursday 28 February 2013 - Paper 1 (Non-Calculator) Higher Tier

18.

7	(a)		$6x - 3y$	2	M1 for an attempt to combine terms in x **or** terms in y correctly eg $5x + x(= 6x)$, $4y - 7y(= -3y)$ A1 for $6x - 3y$ oe
	(b)	$7x + 14 = 7$ or $x + 2 = 1$ $7x = -7$	$x = -1$	2	M1 for correctly expanding the bracket or an attempt to divide both sides by 7 e.g. $7x + 14$ or $x + 2 = 7 \div 7$ oe A1 cao

Pearson Edexcel - Thursday 28 February 2013 - Paper 1 (Non-Calculator) Higher Tier

19.

17			$\frac{12}{13}$	3	M1 for multiplying throughout by 10 oe or writing LHS as a single fraction e.g $2(4x - 1) + 5(x + 4) = 3 \times 10$ or $\frac{2(4x-1)+5(x+4)}{10}$ or $\frac{2(4x-1)}{10} + \frac{5(x+4)}{10}$ M1 (dep) for a complete correct method to obtain linear equation of the form $ax = b$ (condone one arithmetic error in multiplying out the bracket) A1 for $\frac{12}{13}$ oe (decimal equivalent is $0.923\ldots$)

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20.

20		$\frac{3(x+1)}{6} + \frac{2(x+3)}{6} = \frac{3x+3+2x+6}{6}$	$\frac{5x+9}{6}$	3	M1 Use of common denominator of 6 (**or** any other multiple of 6) and at least one numerator correct Eg. $\frac{3(x+1)}{6}$ or $\frac{2(x+3)}{6}$ M1 $\frac{3(x+1)}{6} + \frac{2(x+3)}{6}$ oe A1 cao

Pearson Edexcel - Thursday 8 November 2012 - Paper 2 (Calculator) Higher Tier

21.

22	(a)	$x = \dfrac{-9 \pm \sqrt{9^2 - 4 \times 2 \times -7}}{2 \times 2} = \dfrac{-9 \pm \sqrt{137}}{4}$	$0.676, -5.18$	3	M1 $\dfrac{-9 \pm \sqrt{9^2 - 4 \times 2 \times -7}}{2 \times 2}$ allow substitution of ± 7 for c M1 $\dfrac{-9 \pm \sqrt{137}}{4}$ A1 answers in ranges 0.67 - 0.68 **and** -5.17 to -5.18 **OR** M1 $(x + \dfrac{9}{4})^2$ oe M1 for method leading to $\pm\sqrt{\dfrac{137}{16}} - \dfrac{9}{4}$ A1 answers in ranges 0.67 - 0.68 **and** -5.17 to -5.18
	(b)	Put $y = \dfrac{1}{x}$ and use part (a) Or $7y^2 - 9y - 2 = 0$ $y = \dfrac{--9 \pm \sqrt{(-9)^2 - 4 \times 7 \times (-2)}}{2 \times 7}$ $\dfrac{9 \pm \sqrt{137}}{14}$	$1.48, -0.193$	2	M1 $y = \dfrac{1}{x}$ or $x = \dfrac{1}{y}$ A1 (ft) answers in range 1.47 - 1.48 **and** -0.19 to -0.194 **OR** M1 fully correct method which leads to $7y^2 - 9y - 2 = 0$ **or** $-7y^2 + 9y + 2 = 0$ with correct method to solve (condone sign errors in substitution) A1 (ft) answers in range 1.47 - 1.48 **and** -0.19 to -0.194

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22.

22		$a = 3, b = -4, c = -2$ $x = \dfrac{--4 \pm \sqrt{(-4)^2 - 4 \times 3 \times -2}}{2 \times 3}$ $= \dfrac{4 \pm \sqrt{16+24}}{6} = \dfrac{4 \pm \sqrt{40}}{6}$ $= 1.72075922$ or $= -0.3874258867$ **OR** $x^2 - \dfrac{4}{3}x - \dfrac{2}{3} = 0$ $\left(x - \dfrac{2}{3}\right)^2 - \left(\dfrac{2}{3}\right)^2 - \dfrac{2}{3} = 0$ $x - \dfrac{2}{3} = \sqrt{\left(\dfrac{2}{3}\right)^2 + \dfrac{2}{3}}$ $x = \dfrac{2}{3} \pm \sqrt{\dfrac{10}{9}}$	$1.72, -0.387$	3	M1 for $\dfrac{--4 \pm \sqrt{(-4)^2 - 4 \times 3 \times -2}}{2 \times 3}$ (condone incorrect signs for -4 and -2) M1 for $\dfrac{4 \pm \sqrt{40}}{6}$ or $\dfrac{2 \pm \sqrt{10}}{3}$ A1 for one answer in the range 1.72 to 1.721 and one answer in the range -0.387 to -0.38743 **OR** M1 for $\left(x - \dfrac{2}{3}\right)^2$ oe M1 for method leading to $\dfrac{2}{3} \pm \sqrt{\dfrac{10}{9}}$ oe A1 for one answer in the range 1.72 to 1.721 and one answer in the range -0.387 to -0.38743

Pearson Edexcel - Monday 5 March 2012 - Paper 4 (Calculator) Higher Tier

23.

| 19 | $a = 5, b = 8, c = -6$ $$x = \frac{-8 \pm \sqrt{8^2 - 4 \times 5 \times -6}}{2 \times 5}$$ $$\frac{-8 \pm \sqrt{64 + 120}}{10} = \frac{-8 \pm \sqrt{184}}{10}$$ $= 0.5564659966$ or $= -2.156465997$ OR $$x^2 + \frac{8}{5}x - \frac{6}{5} = 0$$ $$\left(x - \frac{4}{5}\right)^2 - \left(\frac{4}{5}\right)^2 - \frac{6}{5} = 0$$ $$x + \frac{4}{5} = \pm\sqrt{\left(\frac{4}{5}\right)^2 + \frac{6}{5}}$$ $$x = -\left(\frac{4}{5}\right) \pm \sqrt{\frac{46}{25}}$$ | 0.56, –2.16 | 3 | M1 for substitution, $\frac{-8 \pm \sqrt{8^2 - 4 \times 5 \times -6}}{2 \times 5}$ condone one sign error in substitution M1 for $\frac{-8 + \sqrt{184}}{10}$ oe or $\frac{-8 - \sqrt{184}}{10}$ oe A1 for one answer in the range 0.556 to 0.56 **and** one answer in the range –2.156 to –2.16 **OR** M1 for $(x + 0.8)^2$ oe M1 for method leading to $-0.8 \pm \sqrt{1.84}$ oe A1 for one answer in the range 0.556 to 0.56 and one answer in the range –2.156 to –2.16 |

Pearson Edexcel - Monday 5 March 2012 - Paper 4 (Calculator) Higher Tier

24.

| 24 | $5(2x +1)^2 = (4x + 5)(5x - 1)$ $5(4x^2 + 4x + 1) = 20x^2 + 21x - 5$ $20x^2 + 20x + 5 = 20x^2 + 21x - 5$ $20x + 5 = 21x - 5$ $x = 10$ | $x = 10$ | 5 | M1 for intention to multiply each side by $4x + 5$ M1 for attempt to expand $(2x + 1)^2$ or $5(2x + 1)^2$ or $(4x + 5)(5x - 1)$, at least 3 out of 4 terms correct A1 for $20x^2 + 20x + 5$ or $20x^2 + 21x - 5$ oe A1 for $20x^2 + 20x + 5 = 20x^2 + 21x - 5$ oe A1 for 10 |

Pearson Edexcel - Wednesday 9 November 2011 - Paper 3 (Non-Calculator) Higher Tier

25.

20	(a)	$2x^2 - 9x + 4 = (2x - 1)(x - 4)$	$(2x - 1)(x - 4)$	2	M1 $(2x \pm 1)(x \pm 4)$ A1 cao
	(b)	$(2x - 1)(x - 4) = (2x - 1)^2$ $2x - 1 = 0$ or $x - 4 = 2x - 1$ for $x = \frac{1}{2}$ or $x = -3$ OR $2x^2 - 9x + 4 = 4x^2 - 4x + 1$ $2x^2 + 5x - 3 = 0$ $(2x - 1)(x + 3) = 0$ OR $(2x - 1)(x - 4) = (2x - 1)^2$ $(2x - 1)[2x - 1 - (x - 4)] = 0$ $(2x - 1)(x + 3) = 0$	$x = \frac{1}{2}, -3$	4	M1 '$(2x - 1)(x - 4)$' $= (2x - 1)^2$ M1 dep for $2x - 1 = 0$ or for $x - 4 = 2x - 1$ oe A1 for $x = \frac{1}{2}$ or $x = -3$ A1 cao OR M1 attempts to expand RHS (at least 3 terms with two correct) M1 dep attempts to get $ax^2 + bx + c = 0$ (allow one error) or $2x^2 + 5x - 3$ seen A1 $(2x - 1)(x + 3)$ seen or correct substitution into the quadratic formula A1 cao OR M1 '$(2x - 1)(x - 4)$' $= (2x - 1)^2$ M1 dep attempt to factorise $(2x - 1)[2x - 1 - (x - 4)]$ A1 $(2x - 1)(x + 3)$ seen A1 cao [SC: Answer of -3 or $\frac{1}{2}$, no working, scores B1]

Pearson Edexcel - Monday 14 November 2011 - Paper 4 (Calculator) Higher Tier

26.

| 19 | $x^2 + 3 = 7x$
$x^2 - 7x + 3 = 0$

$x = \dfrac{-(-7) \pm \sqrt{(-7)^2 - 4 \times 3}}{2}$

OR
$(x - 3.5)^2 = 3.5^2 - 3 = 9.25$
$x - 3.5 = \pm\sqrt{9.25}$ | $= \dfrac{7 \pm \sqrt{37}}{2}$

OR
$3.5 \pm \sqrt{9.25}$ | 3 | M1 for $x^2 + 3 = 7x$ oe **or** clear intention to multiply all terms by x

M1 for $x = \dfrac{-(-7) \pm \sqrt{(-7)^2 - 4 \times 3}}{2}$ ft from a quadratic equation of the form $ax^2 + bx + c = 0$ where $a,b,c \neq 0$; condone wrong signs for a, b, c in substitution

A1 for $= \dfrac{7 \pm \sqrt{49 - 12}}{2}$ or for $= \dfrac{7 \pm \sqrt{37}}{2}$ as the final exact solution

OR
M1 for $x^2 + 3 = 7x$ oe **or** clear intention to multiply all terms by x
M1 for $(x - 3.5)^2 - 3.5^2 + 3 = 0$ ft from a quadratic equation of the form $ax^2 + bx + c = 0$ where $a,b,c \neq 0$
A1 for $3.5 \pm \sqrt{9.25}$

SC : B2 for both 6.54(1381265..) **and** 0.458(6187349…) |

Pearson Edexcel - Monday 6 June 2011 - Paper 3 (Non-Calculator) Higher Tier

27.

| 27 | $\dfrac{x \times 2(x+1)}{2} - \dfrac{2 \times 2(x+1)}{x+1} = 1 \times 2(x+1)$
$x(x+1) - 4 = 2(x+1)$
$x^2 + x - 4 = 2x + 2$
$x^2 - x - 6 = 0$
$(x - 3)(x + 2) = 0$ | $x = 3, -2$ | 4 | M1 for an attempt to multiply one term of the equation by 2 or $x + 1$ or $2(x + 1)$
or $2 \times x + 1$ with or without cancelling or attempt to write LHS with a common denominator

M1 for attempt to multiply all terms by $2(x + 1)$ with or without cancelling
e.g. $\dfrac{x \times 2(x+1)}{2} - \dfrac{2 \times 2(x+1)}{x+1} = 1 \times 2(x+1)$
Or $x(x + 1) - 4 = 2(x + 1)$

A1 for $x^2 + x - 4 = 2x + 2$ or $x^2 - x - 6 = 0$

A1 cao for 3 and -2 |

Pearson Edexcel - Friday 10 June 2011 - Paper 4 (Calculator) Higher Tier

28.

10	(a)		$7e + 2f$	2	B2 cao (B1 for $7e$ or $+ 2f$ seen)
	(b)	$8x - 4 = 3x - 19$ $8x - 3x = -19 + 4$ $5x = -15$	-3	3	B1 for $8x - 4$ or $3x/4 - 19/4$ seen correctly oe M1 for a fully correct process which results in the terms in x or the constant terms being on one side of the equation from 'ax+b' = 'cx+d' b≠0 A1 cao
	(c)	$y + 4 = 150$ $y = 150 - 4$	146	2	M1 for $y + 4 = 30 \times 5$ or $\dfrac{y}{5} = 30 - \dfrac{4}{5}$ oe A1 for 146

Pearson Edexcel - Friday 10 June 2011 - Paper 4 (Calculator) Higher Tier

29.

18	(a)		c^8k^{20}	1	B1
	(b)	$12x^2 - 3x + 20x - 5$ **OR** <table><tr><td>×</td><td>**3x**</td><td>**(+) 5**</td></tr><tr><td>**4x**</td><td>$12x^2$</td><td>(+)20x</td></tr><tr><td>**-1**</td><td>-3x</td><td>-5</td></tr></table>	$12x^2 + 17x - 5$	2	B2 for fully correct (B1 for 3 out of 4 terms correct in working including signs OR 4 terms correct, ignore signs. In a grid the 20x need not be signed)
	(c)	$(x - 5)(x + 2) = 0$	5 and -2	3	M1 for $(x \pm 5)(x \pm 2)$ A1 for $(x - 5)(x + 2)(= 0)$ B1 ft (dep on M1) for $x = 5$ and -2 **or** M1 for correct substitution in formula allow sign errors in b and c M1 for reduction to $\dfrac{3 \pm \sqrt{49}}{2}$ A1 for 5 and -2 **or** M1 for $(x - \frac{3}{2})^2 - \left(\frac{3}{2}\right)^2 - 10 = 0$ M1 for $\dfrac{3}{2} \pm \sqrt{\dfrac{49}{4}}$ A1 for 5 and -2 **or** T&I B3 both roots (B1 one root)

Pearson Edexcel - Friday 10 June 2011 - Paper 4 (Calculator) Higher Tier

30.

23	(a)	$x(2x + 6) - 3x = 100$ $2x^2 + 6x - 3x = 100$ $2x^2 + 3x - 100 = 0$	Proof	3	M1 for a correct algebraic expression for the area of at least one rectangle eg $x(2x + 6)$ or $2x^2 + 6x$ or $3x$ oe M1 for a correct algebraic expression for the area of the unshaded region eg $x(2x + 6) - 3x (= 100)$ or for eg x(2x+6)=100+3x A1 for completion from eg $2x^2 + 6x - 3x (= 100)$ oe
	(b)	$a = 2 \quad b = 3 \quad c = -100$ $x = \dfrac{-3 \pm \sqrt{3^2 - 4(2)(-100)}}{2(2)}$ $= \dfrac{-3 \pm \sqrt{809}}{4}$ $= 6.36073...$ or $-7.86073...$ **OR** $x^2 + 3/2\,x - 50 = 0$ $(x + \frac{3}{4})^2 - (\frac{3}{4})^2 - 50 = 0$ $x + \dfrac{3}{4} = \pm\sqrt{(\frac{3}{4})^2 + 50}$ $x = 6.36073...$ or $-7.86073...$	6.36	4	M1 for correct substitution in formula allow sign errors in b and c M1 for reduction to $\frac{-3 \pm \sqrt{809}}{4}$ or $\frac{-3 + \sqrt{809}}{4}$ A1 for 6.36 to 6.365 _or_ -7.86 to -7.865 A1 for 6.36 to 6.365 **OR** M1 for $(x + \frac{3}{4})^2$ M1 for $-\frac{3}{4} \pm \sqrt{\frac{9+800}{16}}$ or $-\frac{3}{4} + \sqrt{\frac{9+800}{16}}$ A1 for 6.36 to 6.365 or -7.86 to -7.865 A1 for 6.36 to 6.365 SC: T&I scores 1 mark for 1 correct root or 4 marks for correct length

Pearson Edexcel - Tuesday 9 November 2010 - Paper 3 (Non-Calculator) Higher Tier

31.

23	(a)	$x^2 - 3x + 5x - 15$	$x^2 + 2x - 15$	2	M1 for four correct terms with or without signs, or 3 out of no more than 4 terms with correct signs. The terms may be in an expression or in a table A1 cao
	(b)	$(x + 9)(x - 1) = 0$ OR $a = 1, b = 8, c = -9$ $x = \dfrac{-8 \pm \sqrt{8^2 - 4 \times 1 \times -9}}{2 \times 1}$ $= \dfrac{-8 \pm \sqrt{100}}{2}$ OR $(x + 4)^2 - 16 - 9$ $(x + 4)^2 = 25$ $x = -4 \pm \sqrt{25}$	$x = 1$ or $x = -9$	3	M2 for $(x + 9)(x - 1)$ (M1 for $(x \pm 9)(x \pm 1)$) A1 cao or M1 for correct substitution in formula of 1, 8, ±9 M1 for reduction to $\dfrac{-8 \pm \sqrt{100}}{2}$ A1 cao or M1 for $(x + 4)^2$ M1 for $-4 \pm \sqrt{25}$ A1 cao SC: if no marks score then award B1 for 1 correct root, B3 for both correct roots.

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32.

6	(a)		$6x + 5y$	2	B2 (B1 for either $6x$ or $5y$ seen)
	(b)	$2x = 10 - 3 = 7$ $x = 7 \div 2$	3.5	2	M1 for $2x = 10 - 3$ or $2x = 7$ or $(10 - 3) \div 2$ A1 for 3.5 oe
	(c)(i)		c^{11}	2	B1 accept c^{5+6}
	(ii)		e^8		B1 accept e^{12-4}

Pearson Edexcel - Friday 11 June 2010 - Paper 4 (Calculator) Higher Tier

33.

11	(a)		Base angles of an isosceles triangle are equal	1	B1 mentions **isosceles** (triangle) or **two sides the same** or **base angles equal**. Accept equivalent reasons. Do not accept incorrect statements.
	(b)	$2x = 40$	20	2	M1 for an attempt to move **x** to LHS or -10 to RHS eg -**x** each side or +10 each side or sight of 2**x** or 40 OR to move 3**x** or +30 or sight of -2**x** or -40 A1 cao

Pearson Edexcel - Tuesday 10 November 2009 - Paper 4 (Calculator) Higher Tier

34.

19	(a)	$x^2 - 3x + 5x - 15$	$x^2 + 2x - 15$	2	B2 for $x^2 + 2x - 15$ (B1 for $x^2 - 3x + 5x - 15$ with at least 3 terms correct or 4 terms correct ignoring signs)
	(b)	$\dfrac{29 - x}{4} \times 4 = x \times 4 + 5 \times 4$ $29 - 20 = 4x + x$ $5x = 9$	1.8	3	M1 for multiplying through by 4 or $\dfrac{29}{4} - \dfrac{x}{4} = x + 5$ M1 for correct rearrangement of their 4 terms to separate x and non-x terms A1 for 1.8 oe

Pearson Edexcel - Tuesday 10 November 2009 - Paper 4 (Calculator) Higher Tier

35.

29		$4(2x-1) + 3(x+3)$ $= (x+3)(2x-1)$ $8x - 4 + 3x + 9$ $= 2x^2 - x + 6x - 3$ $2x^2 - 6x - 8 = 0$ $2(x-4)(x+1) = 0$	$x = -1, 4$	5	M1 multiplying both sides by a common denominator of $(x+3)(2x-1)$ oe or $\dfrac{4(2x-1) + 3(x+3)}{(x+3)(2x-1)}$ $(=1)$ or better seen or multiplying all 3 terms by $(x+3)$ or by $(2x-1)$ M1 (indep) for $2x^2 - x + 6x - 3$ oe seen or $8x - 4 + 3x + 9$ oe A1 for $2x^2 - 6x - 8$ oe or $x^2 - 3x - 4 (= 0)$ M1 (dep on M2) for correct method to solve a 3 term quadratic A1 cao for both solutions

OCR GSCE – Tuesday 3 November 2020 – Paper 4 (Calculator) Higher Tier

36.

15	(a)		Correct reason e.g. the factors give +2x or factors are $(3x - 5)(x + 1)$ or the signs are the wrong way round	B1		See appendix
			$(3x - 5)(x + 1)$ and -1 and $\frac{5}{3}$ oe	B2	B1 for the correct factorisation or two correct solutions **FT** from their incorrect factorisation	
	(b)		Correct reason e.g. the $-b$ term should be in the numerator or $\dfrac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$	B1		allow [+] 8 for $-(-8)$ throughout this part see appendix
			$\dfrac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$ and 0.419 and 3.58	B2	B1 for $\dfrac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$ or 0.419 and 3.58 or 0.4188..., 0.4189 or 0.419 and 3.58[1...]	

OCR GSCE – Thursday 5 November 2020 – Paper 5 (Non-Calculator) Higher Tier

37.

2	(a)	2.5 oe	2	M1 for $4x = 13 - 3$ or for $x + \frac{3}{4} = \frac{13}{4}$	Accept $\frac{10}{4}$ or $\frac{5}{2}$ isw Embedded answer scores M1 max
2	(b)	12x + 7 final answer	3	M1 for $10x + 15$ M1 for $2x - 8$	

OCR GSCE – Thursday 5 November 2020 – Paper 5 (Non-Calculator) Higher Tier

38.

15		-7.5 or $-7\frac{1}{2}$ or $-\frac{15}{2}$	3	M1 for $x = 5(x + 6)$ M1 for $x - 5x = 30$ **oe** FT *their* first step	Condone $-\frac{30}{4}$ as final answer Embedded answer scores M2 maximum

OCR GSCE – Thursday 7 November 2019 – Paper 5 (Non-Calculator) Higher Tier

39.

5		5.5 oe	3	M1 for correct first step e.g. $6x - 4x - 10 = 1$ M1 for $6x - 4x = 1 + 10$ FT *their* first step or FT *their* $ax = b$ to $x = \frac{b}{a}$	isw $\frac{11}{2}$ converted to decimal Embedded answer scores M2 max If not shown, M1 implied by $\pm 2x = b$ or $ax = \pm 11$ e.g. M1 for $2x = -9$ leading to $x = -\frac{9}{2}$ oe

OCR GSCE – Tuesday 21 May 2019 – Paper 4 (Calculator) Higher Tier

40.

19		−3.19 [0].52 with some correct algebraic working	4	M2 for correct substitution into the formula, allow one error e.g. $\frac{-8 \pm \sqrt{8^2 - 4 \times 3 \times -5}}{2 \times 3}$ or for e.g. $3[(x + \frac{8}{6})^2 - (\frac{8}{6})^2] - 5 = 0$ oe and $x = \sqrt{\frac{5}{3} + (\frac{8}{6})^2} - \frac{8}{6}$ oe or better or M1 for correct substitution into the formula, allow two errors or for e.g. $3[(x + \frac{8}{6})^2 - (\frac{8}{6})^2] - 5 = 0$ oe or better and A1 for −3.19 or [0].52 or for both solutions correct but to more than 2dp. e.g. −3.189254… or 0.522588….. If **0** scored allow **SC1** for two correct answers with no correct algebraic working.

| 20 | a | $1^4 - 1^2 - 9 = ^-9$
 $2^4 - 2^2 - 9 = 3$

 Sign change, solution between $x = 1$ and $x = 2$ | **3** | **M2** for $1^4 - 1^2 - 9 = ^-9$ and $2^4 - 2^2 - 9 = 3$

 or

 M1 for $1^4 - 1^2 - 9$ or $2^4 - 2^2 - 9$ soi by $^-9$ or 3

 Alternative method
 After $x^4 - x^2 = 9$ seen
 M2 for $2^4 - 2^2 = 12$ and $1^4 - 1^2 = 0$
 A1 for $12 > 9$ and $0 < 9$ so solution between
 $x = 1$ and $x = 2$
 OR
 M1 for $2^4 - 2^2$ or $1^4 - 1^2$ soi by 12 or 0

 Alternative method
 SC3 for using an iterative equation that converges to a value in the range 1.85 to 1.95 **and** concluding statement that $1 < 1.85$ to $1.95 < 2$ oe <br> or
 SC2 for using an iterative equation that converges to a value in the range 1.85 to 1.95

 Alternative method
 SC3 for using quadratic formula (see (b)) leading to a value in the range 1.88 to 1.89 **and** concluding statement that $1 < 1.88$ to $1.89 < 2$ oe <br> or
 SC2 for using quadratic formula (see (b)) leading to a value in the range 1.88 to 1.89 | Accept other values of x used between 1 and 2 (see table in part (b)). For full marks, the two values need to produce a sign change.

 Examples just sufficient for third mark include:
     sign change
     $^-9 < 0 < 3$
     $x = 1$ gives an answer < 0 and
         $x = 2$ gives an > 0
 Examples insufficient for third mark:
     so x lies between 1 and 2

 If candidates <u>refer to</u> their **working** in part **(b)** within part **(a)**, award marks for any of the final 2 alternative methods. |

| | b | Two correct evaluations in the range 1.85 to 1.95, one which gives a positive value and the other giving a negative value

 1.9 | **M3**

 and

 A1dep | **M2** for two correct evaluations between 1 and 2, one which gives a positive value and the other giving a negative value

 or

 M1 for one correct evaluation between 1 and 2

 Dependent on achieving at least **M2**

 OR

 SC1 for 1.9 with no worthwhile working

 Alternative method by iteration
 M1 rearranges to a correct iterative formula (converging or diverging)
 M1 <u>attempts</u> first iteration (either substitution of $1 \le x \le 2$ seen or found to at least 2dp rot)
 M1 continues further iteration(s) to reach x in the range 1.85 to 1.95
 A1 for 1.9

 Alternative method by quadratic formula
 M2 for $[x^2 =] \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-9)}}{2(1)}$ soi by 3.54[1..]
 or **M1** for this formula with at most two errors

 AND

 M1 for $x = \sqrt{their\ 3.54[1..]}$ soi by 1.88 to 1.89
 A1 for 1.9 | Likely values: accept rot to 1 or more dp
<table><tr><th>x</th><th>$x^4 - x^2 - 9$</th></tr><tr><td>1.1</td><td>-8.7459</td></tr><tr><td>1.2</td><td>-8.3664</td></tr><tr><td>1.25</td><td>-8.12109…</td></tr><tr><td>1.3</td><td>-7.8339</td></tr><tr><td>1.4</td><td>-7.1184</td></tr><tr><td>1.5*</td><td>-6.1875</td></tr><tr><td>1.6</td><td>-5.0064</td></tr><tr><td>1.7</td><td>-3.5379</td></tr><tr><td>1.75*</td><td>-2.68359…</td></tr><tr><td>1.8</td><td>-1.7424</td></tr><tr><td>1.85</td><td>-0.70899…</td></tr><tr><td>1.875*</td><td>-0.1560…</td></tr><tr><td>1.9</td><td>0.4221</td></tr><tr><td>1.9375*</td><td>1.3379….</td></tr><tr><td>1.95</td><td>1.656506</td></tr><tr><td>2</td><td>3</td></tr></table>
 Alternative iteration method notes condone missing subscripts

 eg **M1** for $x = \sqrt{\sqrt{9 + x^2}}$

 and **M1** for $\sqrt{\sqrt{9 + 1^2}}$ or 1.77[8..] or 1.78

 If candidates <u>refer to or use</u> their **working** in part **(a)** within part **(b)**, award up to full marks for part **(b)**. |

OCR GSCE – Tuesday 6 November 2018 – Paper 4 (Calculator) Higher Tier

42.

16			$(2x + 3)(x - 11)$	**M2**	**M1** for two brackets which give two correct terms	
			-1.5 oe 11	**B1**	correct or **FT** *their* two linear brackets	

OCR GSCE – Thursday 8 November 2018 – Paper 5 (Non-Calculator) Higher Tier

43.

20	(a)	$[(2x + 1)(3x + 2) =]$ $6x^2 + 3x + 4x + 2$ or better	**M2**	**B1** for 3 out of 4 terms correct	$6x^2 + 7x + 2$, $7x$ counts as 2 terms For B1 accept terms on a grid
		$[x(3x + 5) =]$ $3x^2 + 5x$	**M1**		
		$9x^2 + 12x + 4$	**M1**	**FT** *their* expansions dep on 3 term quadratic	Condone if expression '= 0'
		$(3x + 2)^2$	**A1**		For A1 accept $(3x + 2)(3x + 2)$
		which is a perfect square	**A1**		
20	(b)	Cannot square root a negative value **oe** or for $9x^2 + 12x + 4$ [= 0] and $b^2 - 4ac < 0$ with a, b, c substituted or values shown **oe**	1		

OCR GSCE – Thursday 24 May 2018 – Paper 4 (Calculator) Higher Tier

44.

20				-0.3 5.3	6	**B1** for $(x + 2)(x - 3)$ oe seen	likely seen in $2(x + 2)(x - 3)$ implied by $x^2 - x - 6$
						M1 for $5(x - 3) + 3(x + 2)$ oe or better	implied by $5x - 15 + 3x + 6$ or $8x - 9$
						M1FT for $2x^2 - 10x - 3$ [= 0] or FT *their* correct attempt to form a quadratic equation with at most two errors	$2x^2 - 10x - 3$ [=0] seen scores **3** marks, condone e.g. $2x^2 - 10x = 3$ for **3** marks
						M1FT for $\dfrac{-(-10) \pm \sqrt{(-10)^2 - 4 \times 2 \times -3}}{2 \times 2}$ oe condoning at most two errors or better **FT** *their* 'quadratic equation'	for completing the square see additional guidance
						A1 for each of -0.3 or 5.3 or for both answers correct but to more than 1dp. or **A1FT** for two answers correct to 1 d.p. FT from *their* 'quadratic equation'	For **A1** the correct answers are -0.28388… and 5.28388… and can be rounded or truncated. Note: for **A1FT** they must get **M1** first.

OCR GSCE – Tuesday 2 November 2017 – Paper 4 (Calculator) Higher Tier

45.

| 18 | | −1.85   [0].18 | 4 | **M2** for $\dfrac{-5\pm\sqrt{5^2-4\times3\times-1}}{2\times3}$ or better and condone one error

or

M1 for the formula with at most two errors
and
A1 for −1.85 or [0].18 or for both answers correct but to more than 2dp.
e.g. 0.180... and -1.847... | Accept any correct algebraic method e.g. completing the square
$3[x^2+\frac{5}{3}x+\frac{1}{3}]=0$
$3[(x+\frac{5}{6})^2-\frac{13}{36}]=0$ |

OCR GSCE – Thursday 25 May 2017 – Paper 4 (Calculator) Higher Tier

46.

18	(a)	$(2x-3)(x+4)$ oe	2	**M1** for any two factors that give two correct terms when expanded	If they use another method then award **B1** for both answers correct.
		1.5 oe and −4	1	Correct or **FT** *their* two factors	
	(b)	[0].72 −1.39	3	**M2** for one correct answer or $\dfrac{-2\pm\sqrt{2^2-4\times3\times-3}}{2\times3}$ or better or **M1** for this formula with at most two errors if **0** scored allow **SC1** for answers [0].720... or [0].721 and −1.38.....	for completing the square **M1** for $(x+\frac{1}{3})^2-\frac{10}{9}$ **M1** for $\sqrt{\frac{10}{9}}-\frac{1}{3}$

OCR GSCE – Sample Papers – Paper 6 (Calculator) Higher Tier

47.

2	(a)	(i)	$x>3$	3 3 AO1.3a	**M1** for $4x$ **soi** **M1** for 12 **soi**	
		(ii)	2	1 1 AO1.3a		
	(b)		[+]5 −5	2 2 AO1.3a	**M1** for $x^2=25$ If zero scored **SC1** for 5 seen as answer	
	(c)		[x =] 2 [y =] -1	3 3 AO1.3b	**M1** for eliminating one variable **M1** for correct substitution of *their* x or y	

AQA GSCE – Thursday 4 June 2020 – Paper 2 (Calculator) Higher Tier

48.

29	$5(x^2 + 3)$ or $5x^2 + 15$ or $2x(4x + 1)$ or $8x^2 + 2x$	M1	oe ignore any denominators
	$5(x^2 + 3) = 2x(4x + 1)$ or $5x^2 + 15 = 8x^2 + 2x$	M1dep	oe allow both sides to have denominator $(4x + 1)(x^2 + 3)$ oe
	$3x^2 + 2x - 15 \ (= 0)$	M1dep	oe equation with terms collected eg $3x^2 + 2x = 15$ no denominator allowed unless recovered in subsequent working
	$\dfrac{-2 \pm \sqrt{2^2 - 4 \times 3 \times -15}}{2 \times 3}$ or $\dfrac{-2 \pm \sqrt{184}}{6}$ or $-\dfrac{1}{3} \pm \dfrac{1}{3}\sqrt{46}$ or 1.927... and −2.594... and $3x^2 + 2x - 15 \ (= 0)$ seen	M1	oe ft their 3-term quadratic allow correct factorisation of their 3-term quadratic
	1.93 and −2.59 and $3x^2 + 2x - 15 \ (= 0)$ seen	A1	oe eg 1.93 and −2.59 with $3x^2 + 2x = 15$ seen

	Additional Guidance	
	1.93 and −2.59 and $3x^2 + 2x - 15 \ (= 0)$ not seen	Zero
	1.927... and −2.594... and $3x^2 + 2x - 15 \ (= 0)$ not seen	Zero
	One solution and $3x^2 + 2x - 15 \ (= 0)$ not seen	Zero
29 cont	Missing brackets must be recovered	
	$\dfrac{3x^2 + 2x - 15}{(4x + 1)(x^2 + 3)} = 0$ followed by $3x^2 + 2x - 15 = (4x + 1)(x^2 + 3)$	M1M1M0M0A0
	$\dfrac{3x^2 + 2x - 15}{(4x + 1)(x^2 + 3)} = 0$ followed by 1.93 and −2.59	M1M1M1M1A1

AQA GSCE – Thursday 6 June 2019 – Paper 2 (Calculator) Higher Tier

49.

24	$(x + 6)(x - 2)$ or $\dfrac{-4 \pm \sqrt{4^2 - 4 \times 1 \times -12}}{2 \times 1}$ or $-2 \pm \sqrt{16}$	M1	oe
	-6 and 2	A1	may be seen in inequalities or as intersections with x-axis on the graph must be selected if appearing in a list of values or a table
	$-6 < x < 2$ or $2 > x > -6$	A1ft	ft M1A0 and two values must be a single inequality

Additional Guidance

To award A1ft the values must be used to give a continuous interval	
eg1 $(x + 6)(x - 2)$ followed by $(x =) 6$ and $(x =) -2$ Answer $-2 < x < 6$	M1A0A1ft
eg2 $(x + 6)(x - 2)$ followed by $(x =) 6$ and $(x =) -2$ Answer $6 < x < -2$	M1A0A0ft
$x < 2$ and $x > -6$	M1A1A0
$-6 < x > 2$	M1A1A0
$-6 \leqslant x < 2$	M1A1A0
$-6 < x < 2$ in working with different answer on answer line	M1A1A0
$-6 < x < 2$ in working with integers on answer line	M1A1A0

AQA GSCE – Tuesday 11 June 2019 – Paper 3 (Calculator) Higher Tier

50.

4	-3 and 5	B1	

AQA GSCE – Tuesday 11 June 2019 – Paper 3 (Calculator) Higher Tier

51.

18(a)	$3x^2 - 9x - 4 = 0$ or $-3x^2 + 9x + 4 = 0$	B1	must see $= 0$ on answer line

Additional Guidance

Do not accept $x9$ or $9 \times x$ for $9x$	
$3x^2 + -9x + -4 = 0$	B1
$3x^2 - +9x - +4 = 0$	B0

	$\dfrac{--9 \pm \sqrt{(-9)^2 - 4 \times 3 \times -4}}{2 \times 3}$ or $\dfrac{9 \pm \sqrt{129}}{6}$ or $\left(x - \dfrac{3}{2}\right)^2 - \dfrac{9}{4} = \dfrac{4}{3}$ or $\dfrac{3}{2} \pm \sqrt{\dfrac{43}{12}}$ or 3.392... or 3.393 or −0.392... or −0.393	M1	oe correct or ft their 3-term quadratic seen
18(b)	3.39 and −0.39	A1ft	correct or ft their 3-term quadratic seen ft answers must be rounded to 2 dp

Additional Guidance	
The word 'and' does not need to be seen to award A mark	
Full fraction line, correct full square root, ± and $(-9)^2$ or 9^2 must be seen to award M1 but can be recovered by sight of correct solution(s)	
$3x^2 - 9x + 4 = 0$ in 18(a) $\dfrac{9 \pm \sqrt{33}}{6}$ or $\dfrac{3}{2} \pm \sqrt{\dfrac{11}{12}}$ or 2.457... or 0.542... 2.46 and 0.54	M1 A1ft
3.39 and −0.39 on answer line with no incorrect working	M1A1
2.46 and 0.54 on answer line with no incorrect working	M1A1ft
One correct answer with no incorrect working	M1A0

AQA GSCE – Tuesday 6 November 2018 – Paper 1 (Non - Calculator) Higher Tier

52.

	Alternative method 1		
	$(x + a)(x + b)$	M1	where $ab = \pm12$ or $a + b = -1$
	$(x - 4)(x + 3)$	A1	
	4 and –3	A1	SC1 4 or –3 with no or one incorrect answer
	Alternative method 2		
	$\dfrac{(--)1 \pm \sqrt{((-)1)^2 - 4(1)(-12)}}{2(1)}$ or $\dfrac{1 \pm \sqrt{1 + 48}}{2}$ or $\dfrac{1 \pm \sqrt{49}}{2}$	M1	oe allow one sign error
12	$\dfrac{(--)1 \pm \sqrt{((-)1)^2 - 4(1)(-12)}}{2(1)}$ or $\dfrac{1 \pm \sqrt{1 + 48}}{2}$ or $\dfrac{1 \pm \sqrt{49}}{2}$	A1	oe fully correct
	4 and –3	A1	SC1 4 or –3 with no or one incorrect answer
	Alternative method 3		
	$\left(x - \dfrac{1}{2}\right)^2 \ldots$	M1	
	$\left(x - \dfrac{1}{2}\right)^2 - \left(\dfrac{1}{2}\right)^2 - 12 (= 0)$	A1	oe equation
	4 and –3	A1	SC1 4 or –3 with no or one incorrect answer
	Additional Guidance		
	4 and –3 with no working		M1A1A1
	M1 can be scored amongst incorrect attempts to factorise		
	Condone trailing bracket missing eg $(x - 4)(x + 3$		M1A1

AQA GSCE – Tuesday 6 November 2018 – Paper 1 (Non - Calculator) Higher Tier

53.

	Any two of $x(x-2)$ and $7(x+4)$ and $(x-2)(x+4)$	M1	oe $x(x-2)$ and $7(x+4)$ cannot be denominators
	correct equation including $x(x-2)$ and $7(x+4)$ and $(x-2)(x+4)$	M1dep	
	$x^2 - 2x + 7x + 28 = x^2 + 4x - 2x - 8$	M1dep	oe all brackets must be expanded
	-12	A1	
	Alternative method 2		
22	$\frac{x(x-2)}{x+4} + 7 = x - 2$	M1	
	$\frac{x(x-2)}{x+4} = x - 9$ or $x(x-2) = (x-9)(x+4)$	M1dep	
	$x^2 - 2x = x^2 - 9x + 4x - 36$	M1dep	oe all brackets must be expanded
	-12	A1	
	Alternative method 3		
	$x + \frac{7(x+4)}{x-2} = x + 4$	M1	
	$\frac{7(x+4)}{x-2} = 4$ or $7(x+4) = 4(x-2)$	M1dep	
	$7x + 28 = 4x - 8$	M1dep	oe all brackets must be expanded
	-12	A1	
	Additional Guidance		
	In Alt 1, do not allow $x \times x - 2$ or $7 \times x + 4$ unless recovered		

AQA GSCE – Thursday 8 November 2018 – Paper 2 (Calculator) Higher Tier

54.

Alternative method 1		
$35x + 6x = ax$ or $35 + 6 = a$ or $41x = ax$	M1	
$a = 41$	A1	
$40 + 3b = 13$	M1	oe
$b = -9$	A1	SC3 $a = 41$, $b = -27$ or $a = 41$, $b = \dfrac{5}{3}$

Alternative method 2		
$35x + 40 + 6x + 3b$ or $41x + 40 + 3b$	M1	
$35x + 6x = ax$ or $35 + 6 = a$ **and** $40 + 3b = 13$	M1dep	oe eg $41x = ax$ and $3b = -27$
$a = 41$	A1	implies first M1 only
$b = -9$	A1	SC3 $a = 41$, $b = -27$ or $a = 41$, $b = \dfrac{5}{3}$

7

Additional Guidance	
$a = 41$ and $b = -9$	M1A1M1A1
$a = 41$ or $b = -9$	M1A1
$35x$, 40, $6x$ and $3b$ seen without addition signs shown or implied	M0
$35x + 40 + 6x + b$ leading to an answer of $a = 41$ and $b = -27$	SC3
$35x + 8 + 6x + 3b$ leading to an answer of $a = 41$ and $b = \dfrac{5}{3}$	SC3
$35x + 8 + 6x + b$ leading to an answer of $a = 41$ and $b = 5$	M1A1
$a = 41x$	M0
For $\dfrac{5}{3}$ accept 1.66... or 1.67	
Condone multiplication signs eg $35 \times x$ for $35x$	

AQA GSCE – Monday 12 November 2018 – Paper 3 (Calculator) Higher Tier

55.

	$x^2 + (3x + p)^2 = 53$	M1	oe
	$9x^2 + 3xp + 3xp + p^2$ or $9x^2 + 6xp + p^2$	M1	Expands $(3x + p)^2$ correctly
27(a)	$x^2 + (3x + p)^2 = 53$ and $x^2 + 9x^2 + 3xp + 3xp + p^2 = 53$ and $10x^2 + 6px + p^2 - 53 = 0$ or $x^2 + (3x + p)^2 = 53$ and $x^2 + 9x^2 + 6xp + p^2 = 53$ and $10x^2 + 6px + p^2 - 53 = 0$	A1	
	Additional Guidance		

	$7 = 3 \times 2 + p$ or $7 = 6 + p$ or $p = 1$	M1	oe Substitutes $x = 2$ into given equation $10(2)^2 + 6p(2) + p^2 - 53 = 0$ or $p^2 + 12p - 13 = 0$ or $(p - 1)(p + 13)$ or $p = 1$ (and $p = -13$)
	$10x^2 + 6x + 1 - 53 \ (= 0)$ or $10x^2 + 6x - 52 \ (= 0)$ or $5x^2 + 3x - 26 \ (= 0)$	M1dep	oe equation Substitutes their p into given equation
	$(5x + 13)(x - 2)$ or $\dfrac{-3 \pm \sqrt{3^2 - 4 \times 5 \times -26}}{2 \times 5}$ or $-\dfrac{3}{10} \pm \sqrt{\dfrac{529}{100}}$	M1	oe Correct factorisation of their 3-term quadratic or correct substitution in formula for their 3-term quadratic or correct completion of square to expression for x
27(b)	$(x =) -2.6$	A1	oe
	$(-2.6, -6.8)$	A1	oe

Additional Guidance	
After scoring first M1, they substitute $p = -13$ $(p - 1)(p + 13)$ or $p = 1$ (and $p = -13$)	M1
$10x^2 - 78x + 169 - 53 = 0$ or $10x^2 - 78x + 116 = 0$ or $5x^2 - 39x + 58 = 0$	M1dep
$(5x - 29)(x - 2)$ or $\dfrac{--39 \pm \sqrt{(-39)^2 - 4 \times 5 \times 58}}{2 \times 5}$ or $\dfrac{39}{10} \pm \sqrt{\dfrac{361}{100}}$	M1dep A0 A0

AQA GSCE – Thursday 7 June 2018 – Paper 2 (Calculator) Higher Tier

56.

18	5 and 6 with no incorrect evaluation seen for 3^5 or 3^6 or 5 and 6 with no incorrect evaluation seen for $\sqrt[5]{300}$ or $\sqrt[6]{300}$	B1	5 and 6 in either order allow any evaluations truncated or rounded to 2 sf or 1 sf
	Additional Guidance		
	5 and 6 with either 3^5 or 3^6 evaluated incorrectly		B0
	3^5 or 3^6		B0
	243 and 729		B0
	$3^5 = 243$ Allow 240 or 200 (with no incorrect value seen) $3^6 = 729$ Allow 720 or 730 or 700 (with no incorrect value seen)		
	$\sqrt[5]{300} = 3.1(2...)$ or 3.13 $\sqrt[6]{300} = 2.5(8...)$ or 2.59 or 2.6		

AQA GSCE – Thursday 2 November 2017 – Paper 1 (Non - Calculator) Higher Tier

57.

18	$-\dfrac{3}{2}$ and $\dfrac{2}{5}$	B1	

AQA GSCE – Thursday 6 November 2017 – Paper 2 (Calculator) Higher Tier

58.

	Alternative method 1		
	$12x - 8$	M1	May be seen in a grid
	their $12x - 2x = -5 +$ their 8 or $10x = 3$ or their $-8 + 5 = 2x -$ their $12x$ or $-3 = -10x$	M1	Collecting two terms in x and two constant terms correctly oe eg $10x - 3 = 0$
	0.3 or $\dfrac{3}{10}$	A1ft	ft M1M0 or M0M1 with exactly one error
5	**Alternative method 2**		
	$\dfrac{x}{2} - \dfrac{5}{4}$	M1	
	$3x -$ their $\dfrac{x}{2} =$ their $-\dfrac{5}{4} + 2$ or $\dfrac{5}{2}x = \dfrac{3}{4}$ or $-2 +$ their $\dfrac{5}{4} =$ their $\dfrac{x}{2} - 3x$ or $-\dfrac{3}{4} = -\dfrac{5}{2}x$	M1	Collecting two terms in x and two constant terms correctly oe eg $\dfrac{5}{2}x - \dfrac{3}{4} = 0$
	0.3 or $\dfrac{3}{10}$	A1ft	ft M1M0 or M0M1 with exactly one error

Additional Guidance is on the next page

Additional Guidance		
$12x - 2 = 2x - 5$		M0
$10x = -3$		M1
$x = -0.3$		A1ft
$12x - 8 = 2x - 5$		M1
$10x = -5$		M0
$x = \dfrac{-5}{10}$		A1ft
$12x - 8 = 2x - 5$		M1
$14x = 3$		M0
$x = \dfrac{3}{14}$		A1ft
$12x - 8 = 2x - 5$		M1
$14x = -13$		M0
$x = -\dfrac{13}{14}$ (two errors)		A0ft
$12x - 8 = 8x - 20$		M1M0A0
Any ft answer must be exact or rounded or truncated to at least 2 dp		
The last two marks can be implied without the collection of terms seen eg $12x - 6 = 2x - 5$ and answer 0.1		M0M1A1ft
Collecting terms before the bracket has been expanded		Zero

(Note: The "5" label appears in the leftmost column spanning the middle of the table.)

AQA GSCE – Thursday 6 November 2017 – Paper 2 (Calculator) Higher Tier

59.

	Alternative method 1		
27	$x(x + 2)$ or $x^2 + 2x$ or $2x \times 4$ or $8x$ or $4(x + 2)$ or $4x + 8$	M1	
	$x(x + 2)$ or $x^2 + 2x$ and $2x \times 4$ or $8x$ and $4(x + 2)$ or $4x + 8$	M1dep	oe eg $\dfrac{x(x+2)-2x \times 4}{4(x+2)}$
	$x(x + 2) - 2x \times 4 = 4(x + 2)$	M1dep	oe equation with fractions eliminated dep on M2
	$x^2 - 10x - 8 (= 0)$	A1	oe 3-term quadratic equation with terms collected
	$\dfrac{--10 \pm \sqrt{(-10)^2 - 4 \times 1 \times -8}}{2 \times 1}$ or $\dfrac{10 \pm \sqrt{100 + 32}}{2}$ or $\dfrac{10 \pm \sqrt{132}}{2}$ or $5 \pm \sqrt{5^2 + 8}$ or $5 \pm \sqrt{33}$ or [10.744, 10.745] and [−0.745, −0.744]	M1	oe Correct for their 3-term quadratic Allow correct factorisation of their 3-term quadratic
	10.74 and −0.74 with $x^2 - 10x - 8 (= 0)$ oe seen	A1	Must both be to 2 decimal places

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	Alternative method 2 (from $\dfrac{x}{4} = 1 + \dfrac{2x}{x+2}$)		
27	$x(x+2)$ or $x^2 + 2x$ or $(x+2) + 2x$ or $3x + 2$ or $12x + 8$	M1	
	$\dfrac{x(x+2)}{4}$ or $\dfrac{x^2 + 2x}{4}$ and $\dfrac{x+2+2x}{x+2}$ or $\dfrac{3x+2}{x+2}$	M1dep	
	$x(x+2) = 4(x + 2 + 2x)$ or $x(x+2) = 4(3x + 2)$	M1dep	oe equation with fractions eliminated dep on M2
	$x^2 - 10x - 8 \ (= 0)$	A1	oe 3-term quadratic equation with terms collected
	$\dfrac{--10 \pm \sqrt{(-10)^2 - 4 \times 1 \times -8}}{2 \times 1}$ or $\dfrac{10 \pm \sqrt{100 + 32}}{2}$ or $\dfrac{10 \pm \sqrt{132}}{2}$ or $5 \pm \sqrt{5^2 + 8}$ or $5 \pm \sqrt{33}$ or [10.744, 10.745] and [−0.745, −0.744]	M1	oe Correct for their 3-term quadratic Allow correct factorisation of their 3-term quadratic
	10.74 and −0.74 with $x^2 - 10x - 8 \ (= 0)$ oe seen	A1	Must both be to 2 decimal places

Mark scheme continues on the next page

Additional Guidance is on the next page

Alternative method 3 (from $\dfrac{x}{4} - 1 = \dfrac{2x}{x+2}$)			
$\dfrac{x-4}{4}$	M1		
$(x-4)(x+2)$ or $x^2 - 4x + 2x - 8$ or $x^2 - 2x - 8$ and $2x \times 4$ or $8x$	M1dep		
$(x-4)(x+2) = 2x \times 4$ or $x^2 - 4x + 2x - 8 = 8x$	M1dep	oe equation with fractions eliminated dep on M2	
$x^2 - 10x - 8 \, (= 0)$	A1	oe 3-term quadratic equation with terms collected	
$\dfrac{--10 \pm \sqrt{(-10)^2 - 4 \times 1 \times -8}}{2 \times 1}$ or $\dfrac{10 \pm \sqrt{100 + 32}}{2}$ or $\dfrac{10 \pm \sqrt{132}}{2}$ or $5 \pm \sqrt{5^2 + 8}$ or $5 \pm \sqrt{33}$ or [10.744, 10.745] and [−0.745, −0.744]	M1	oe Correct for their 3-term quadratic Allow correct factorisation of their 3-term quadratic	
10.74 and −0.74 with $x^2 - 10x - 8 \, (= 0)$ oe seen	A1	Must both be to 2 decimal places	

Additional Guidance		
10.74 and −0.74 from T & I or with no working		6 marks
10.74 or −0.74 from T & I or with no working		Zero
In quadratic formula, do not allow -10^2 for $(-10)^2$ unless recovered		

AQA GSCE – Thursday 8 June 2017 – Paper 2 (Calculator) Higher Tier

60.

	Alternative method 1		
21	$5x^2 - 10x - 4\ (=0)$ or $-5x^2 + 10x + 4\ (=0)$	B1	If no rearrangement seen implied by $a = 5,\ b = -10,\ c = -4$ or $a = -5,\ b = 10,\ c = 4$ seen or used correctly
	$\dfrac{--10 \pm \sqrt{(-10)^2 - 4 \times 5 \times -4}}{2 \times 5}$	M1	ft their 3-term quadratic (equation) **seen** Allow one sign error Allow 10^2 for $(-10)^2$ (do not count as a sign error) Allow recovery of invisible brackets Conceptual error (omission of square root, incomplete square root symbol, $\pm$ not included, short fraction line) is M0 unless recovered
	$\dfrac{--10 \pm \sqrt{(-10)^2 - 4 \times 5 \times -4}}{2 \times 5}$ or $\dfrac{10 \pm \sqrt{100 + 80}}{10}$ or $\dfrac{10 \pm \sqrt{180}}{10}$ or $\dfrac{10 \pm 6\sqrt{5}}{10}$ or $2.341(...)$ or 2.342 and $-0.341(...)$ or -0.342	A1ft	Fully correct substitution ft their 3-term quadratic (equation) **seen** oe eg $\dfrac{5 \pm 3\sqrt{5}}{5}$ Allow 10^2 for $(-10)^2$ Allow recovery of invisible brackets Two correct solutions > 2 dp for their 3-term quadratic equation
	2.34 and -0.34	A1ft	ft B0M1A1ft ft answers must be rounded to 2 dp

	Alternative method 2		
21 cont	$5(x^2 - 2x - \frac{4}{5})$ (= 0) or $x^2 - 2x - \frac{4}{5}$ (= 0) or $5(x^2 - 2x) = 4$ or $x^2 - 2x = \frac{4}{5}$	B1	May be implied
	$5[(x - 1)^2 - 1^2 - \frac{4}{5}]$ (= 0) or $(x - 1)^2 - 1^2 - \frac{4}{5}$ (= 0) or $5[(x - 1)^2 - 1^2] = 4$ or $(x - 1)^2 - 1^2 = \frac{4}{5}$	M1	ft their 3-term quadratic (equation) **seen** Allow one sign error but $(x - 1)^2$ must be correct
	$1 \pm \sqrt{1^2 + \frac{4}{5}}$ or 2.341(...) or 2.342 and −0.341(...) or −0.342	A1ft	Fully correct ft their 3-term quadratic (equation) **seen** oe eg $\frac{5 \pm 3\sqrt{5}}{5}$ Two correct solutions > 2 dp for their 3-term quadratic equation **seen**
	2.34 and −0.34	A1ft	ft B0M1A1ft ft answers must be rounded to 2 dp

Additional Guidance continues on the next page

		Additional Guidance	
		Do not count a sign error in a (or b) as two sign errors eg If a should be –5 but a = 5 is used in both $4ac$ and $2a$, only count as one sign error	
		Final A1 mark can be awarded if both answers seen in working but only one is written on answer line	
21 **cont**		$5x^2 + 10x - 4$ (= 0) **seen** with solutions –2.34 and 0.34 (no incorrect method seen)	B0M1A1ftA1ft
		$5x^2 - 10x + 4$ (= 0) **seen** with solutions 0.55 and 1.45 (no incorrect method seen)	B0M1A1ftA1ft
		$5x^2 + 10x + 4$ (= 0) **seen** with solutions –0.55 and –1.45 (no incorrect method seen)	B0M1A1ftA1ft
		Note that the pairs of solutions seen in the three rows above can come from incorrect method so will not always score 3 marks	
		2.34 and –0.34 with no working or from T & I	4 marks
		2.34 or –0.34 with no working or from T & I	Zero
		2.3 and/or –0.3 with no working or from T & I	Zero

AQA GSCE – Tuesday 13 June 2017 – Paper 3 (Calculator) Higher Tier

61.

	a = 2	B1	May be embedded	
	b = 5	B1	May be embedded	
12	Additional Guidance			
	$(2r^5)^4$			B1B1
	$(r^5)^4$			B1
	2^4 = 16 on its own is not enough			B0
	a = 5 and b = 2			B0B0

AQA GSCE – Sample Paper 1 (Non - Calculator) Higher Tier

62.

6	$3 \times 1 - 1^3 = 3 - 1$ $= 2$ and correct	B1	Condone No, they should be 1 and –2 for B1B1 SC1 $w = -2$
	$3 \times (-1) - (-1)^3 = -3 + 1$ $= -2$ and incorrect	B1	

AQA GSCE – Sample Paper 2 (Calculator) Higher Tier

63.

11	$(x - 4)(x + 8) = 0$	B1	

AQA GSCE – Sample Paper 2 (Calculator) Higher Tier

64.

25(a)	**Alternative method 1**		
	$a = 2$ or $2(x^2 - 3x + 2.5)$ or $2(x^2 - 3x) + 5$	M1	
	$x^2 - 3x = (x - 1.5)^2 - 1.5^2$	M1dep	oe ft their $x^2 - 3x$
	$a = 2$ and $b = 1.5$ and $c = 0.5$	A1	oe eg $2(x - 1.5)^2 + 0.5$
	Alternative method 2		
	$a = 2$	B1	
	$x^2 - bx - bx + b^2$ or $x^2 - 2bx + b^2$ or $-2ab = -6$ or $-ab = -3$ or $b = 1.5$	M1	oe
	$a = 2$ and $b = 1.5$ and $c = 0.5$	A1	oe eg $2(x - 1.5)^2 + 0.5$

	Alternative method 1		
	their $2(x-1.5)^2 = 8.5 -$ their 0.5	M1	
	their $(x-1.5) = \pm\sqrt{\dfrac{8.5 - \text{their } 0.5}{2}}$	M1dep	oe
	3.5 and -0.5	A1	oe
	Alternative method 2		
25(b)	$2x^2 - 6x - 3.5\,(= 0)$ or $4x^2 - 12x - 7\,(= 0)$	M1	oe 3-term quadratic equation or expression
	Correct use of quadratic formula eg $\dfrac{--12 \pm \sqrt{(-12)^2 - 4\times4\times-7}}{2\times4}$ or correct factorisation eg $(2x-7)(2x+1) = 0$	M1dep	oe
	3.5 and -0.5	A1	oe