

Quadratics Review Packet Answers

1. Unit penalty (UP) is applicable where indicated.

(a) $(3x - 2)(x + 5)$ (A1)(A1) 2

(b) $(3x - 2)(x + 5) = 0$
 $x = \frac{2}{3}$ or $x = -5$ (A1)(ft)(A1)(ft)(G2) 2

(c) $x = \frac{-13}{6}(-2.17)$ (A1)(A1)(ft)(G2) 2

Note: (A1) is for $x =$, (A1) for value. (ft) if value is half way between roots in (b).

(d) Minimum $y = 3\left(\frac{-13}{6}\right)^2 + 13\left(\frac{-13}{6}\right) - 10$ (M1)

Note: (M1) for substituting their value of x from (c) into $f(x)$

$= -24.1$ (A1)(ft)(G2) 2

[8]

2. (a) $220 = 2(W + x)$ (M1)

Therefore $W = \frac{220 - 2x}{2}$ or $110 - x$ (A1)

(b) Area = $x(110 - x)$ (allow follow through from part (a)) (A1)

(c) Area = $70(110 - 70) = 2800 \text{ m}^2$ (allow follow through from part (b)) (A1)

[4]

3. (a) Put $x = 0$ to find $y = -2$ (M1)
 Coordinates are $(0, -2)$ (A1) (C2)

Note: Award (M1)(A0) for -2 if working is shown. If not, award (M0)(A0).

(b) Factorise fully, $y = (x - 2)(x + 1)$. (A1)(A1)
 $y = 0$ when $x = -1, 2$. (A1)(A1)
 Coordinates are $A(-1, 0), B(2, 0)$. (A1)(A1) (C6)

Note: Award (C2) for each correct x value if no method shown and full coordinates not given. If the quadratic formula is used correctly award (M1)(A1)(A1)(A1)(A1)(A1). If the formula is incorrect award only the last (A1)(A1) as ft.

[8]

4. (a) $y = x^2 + 3$ (A1)
- (b) $y = (x - 2)^2$ (A1)
- (c) $y = (x - 2)^2 + 3$ (A2) 4

[4]

5. (a) $l = 5 + 2x$ (A1) 1
- (b) Area of picture plus frame = $(5 + 2x)^2$
 Therefore $A = (5 + 2x)^2 - 5^2$
OR
 Area of picture plus frame = 49 cm^2 (M1) 2
 Since it is a square, length of one side = 7 cm (M1)
 $(2x + 5) = 7 \text{ cm}$ (M1)
 $x = 1 \text{ cm}$ (A1)

- (c) $(5 + 2x)^2 - 5^2 = 24$ (M1)
 $25 + 20x + 4x^2 - 25 = 24$
 $4x^2 + 20x - 24 = 0$ (M1)
 $x^2 + 5x - 6 = 0$
 $(x - 1)(x + 6) = 0$ (A1)
 $x = 1$ or $x = -6$
 The width is 1 cm (A1) 4

Note: For $4x^2 + 20x - 24 = 0$ correctly solved with no work shown and $x = 1$ give full marks.

[7]

6. (a) $A = x^2 + x$ or any equivalent unsimplified expression (A1)(A1) (C2)
Note: Award (A1) for each term.

- (b) $x^2 + x = 30$ or $x^2 + x - 30 = 0$ (C1)
Note: The answer must be an equation.

- (c) $(x - 5)(x + 6) = 0$ or reasonable attempt to use formula. (M1)(M1)
Note: Award (M1) for both signs wrong or one error in quadratic formula (if used).

- $x = 5$ or $x = -6$ (A1)(A1) (C4)
Note: Award (A2) d for $x = 5$ seen with no other working.

- (d) $x = 5$ because **length** must be positive (must have reason for the mark.) (C1)

[8]

7. Unit penalty (UP) is applicable where indicated.

- (a) $P(\text{rectangle}) = 2x + 2(x + 2) = 4x + 4$ cm (A1) (C1)
(UP)
- (b) Side of square = $(4x + 4)/4 = x + 1$ cm (A1)(ft) (C1)
(UP)
- (c) (i) $2x^2 + 4x + 1 = 49$ or equivalent (M1)
 $(x + 6)(x - 4) = 0$
 $x = -6$ and 4 (A1)
Note: award (A1) for the values or for correct factors
Choose $x = 4$ (A1)(ft) (C3)
Note: Award (A1)(ft) for choosing positive value.
- (ii) Area of square = $5 \times 5 = 25$ cm² (A1)(ft) (C1)
Note: Follow through from both (b) and (c)(i). (UP)

[6]

8. (a) $x^2 - 5x + 6 = 0$
 $(x - 2)(x - 3) = 0$ (A1)
 $x = 2$ (A1)
 $x = 3$ (A1)
- (b) $(2, 0)$
 $(3, 0)$ (A1)

Notes: Follow through from part (a). Both must be correct and written as coordinates for (A1)

[4]

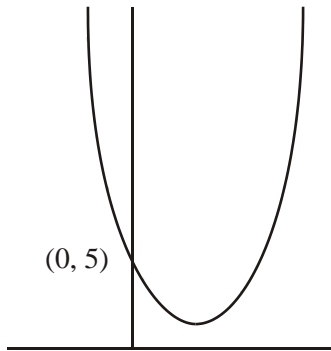
9. (a) $(x + 2)(x - 4)$ (A1)
- (b) (i) $(-2, 0)$ (A1)
- (ii) $(1, -9)$ (A1)(A1)

[4]

10. (a) (ii) (A2) (C2)
- (b) (i) (A2) (C2)
- (c) (iii) (A2) (C2)
- (d) (iv) (A2) (C2)

[8]

11. (a)



(A3) (C3)

*Notes: Award (A1) for point (0,5) indicated.
Award (A2) for correct shape.*

(b) (1.5, 0.5)

(A1)(A1) (C2)

(c) $x = 1.5$

(A1) (C1)

[6]

12. (a) $y = x(5 - x)$ or $y = 5x - x^2$ or $25 = c + 5k$
 $c = 0, k = 5$

(M1)

(A1)(A1) (C3)

Note: Award (A1) if no method is indicated but $c = 0$ or $k = 5$ is given alone.

(b) Vertex at $x = \frac{-b}{2a} = \frac{-5}{-2} = 2.5$

(M1)(A1)

$y = 5(2.5) - 2.5^2 = 6.25$

(M1)(A1)

Note: The substitutions must be attempted to receive the method marks.

Q(2.5, 6.25)

(A1) (C5)

Notes: Coordinate pair is required for (A1) but Q is not essential. If no working shown and answer not fully correct, award (G2) for each correct value and (A1) for coordinate brackets. However, if values are close but not exactly correct (eg (2.49, 6.25)) award only (G1) for each less precise value. In this case AP might also apply if number of digits is inappropriate.

If differentiation is used, award (M1) for correct process, (A1) for $x = 2.5$, (M1)(A1) or (G2) for 6.25 and (A1) for coordinate brackets.

[8]

13.

equation	sketch
(i)	2
(ii)	4
(iii)	3
(iv)	1

(A2)

(A2)

(A2)

(A2) (C8)

Note: Award (A2) for each correct sketch.

[8]

14. (a) $6x + 3 - 6 + 2x = 13$

$8x = 16$

(M1)

$x = 2$

(A1)

(C2)

(b) $(x + 3)(x - 1)$

(A1)(A1)

(C2)

(c) $x = 1.64575..$

$x = 1.65$

(A2)

(C2)

Note: If formula is used award (M1)(A1) for correct solution. If graph is sketched award (M1)(A1) for correct solution.

[6]

15. (a) $(x - 5)(x + 5)$

(M1)(A1)(A1) (C3)

(b) $(x - 4)(x + 1)$

(M1)(A1)(A1) (C3)

(c) $x = 4$

(A1)

$x = -1$

(A1) (C2)

[8]

16. (a) $x + x + y = 50$ (A1)
 $y = 50 - 2x$ (A1) (C2)
- (b) $A(x) = x(50 - 2x)$ or $A(x) = 50x - 2x^2$ (A2)(C2)
- (c) $50x - 2x^2 = 200$ (M1)
 $x^2 - 25x + 100 = 0$
 $(x - 20)(x - 5) = 0$
 $x = 20$ or $x = 5$ (A1)
- dimensions: 5 m \times 40 m or
- 5 m

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40 m (A2) or (C2)

OR

dimensions: 10 m \times 20 m or

- 10 m

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20 m (A2) or (C2)(C4)

[8]

17. (a) $(x - 3)(x + 1)$ (A1)(A1) (C2)
Note: Award (A0)(A1) if the signs are reversed.
- (b) A(1, 0), B(3, 0) (A1)(A1) (C2)
- (c) $x = 1$ or $x = \frac{(-1+3)}{2} = 1$ or $x = \frac{-(-2)}{2(1)} = 1$ (A1)(A1) (C2)
Note: Award (A1) for $x =$ and (A1) for 1.
- (d) C(1, -4) (A1)(A1) (C2)

[8]

18. (a) $a = 2, b = 20, c = 9, d = 8, e = 32$ (A2) 2
Note: Award (A2) for all 5 correct, (A1) for 3 or 4 correct, (A0) for 2 or less correct.
- (b) $A = 12x - x^2$ (C1) 1
- (c) $\frac{dA}{dx} = 12 - 2x$ (A1)
A is maximum when $12 - 2x = 0$ (M1)
 \Rightarrow length = 6m and width = 6m (A1)
- OR**
length = 6m and width = 6m (A2) 3

[6]

19. (a) $(2x - 5)(x + 1)$ (A1)(A1)

(b) $x = \frac{5}{2} = 2.5$ or -1 (A1)(A1)

[4]

20. (a) Profit = Income – Cost

$$P(x) = 150x - 0.6x^2 - (2600 + 0.4x^2) \quad (\text{M1})$$

$$= 150x - 0.6x^2 - 2600 - 0.4x^2 \quad (\text{M1})$$

Note: Award (M2) for either line seen without the other, but award only (M1) if omission of brackets results in $+ 0.4x^2$.

$$= -x^2 + 150x - 2600 \quad (\text{AG}) \quad 2$$

- (b) maximum profit when $x = -\frac{-150}{2 \times -1}$ or $x = -\frac{20+130}{2}$ (M1)
 = 75 machines (A1)
 or (G2) 2

Note: Sketch or table of values from GDC can receive (M1) as long as the values are appropriate. Table must include at least evaluation for 74, 75, 76, and sketch must show 75 beneath the maximum, however, any non-integer answer must receive (A0). If differentiation is used, award (M1) for $-2x + 150 = 0$.

- (c) $I(75) = 150(75) - 0.6(75)^2$ (M1)
 = \$7875 (A1)
 Selling price per machine = $\frac{7875}{75}$ (M1)
 = \$105 (A1) 4

Notes: If $P(75)$ or $C(75)$ used, award M0 A0 but ft with candidate's value to the selling price.

- (d) $P(x) = 0$ or $(x - 20)(130 - x) = 0$. (M1)
 $x = 20$ (130 need not be mentioned) (A2)
 Smallest number must be 21. (A1) 4

*Notes: If no working shown:
 Award (G2) if answer is 20, $x > 20$ or $x = 20$,
 Award (G3) if answer is 21 or $x = 21$.
 A sketch of the function showing the intercepts receives (M1) with (A2) or (A3) for **separate** indication of answer 20 or 21 respectively. If brackets are expanded and quadratic formula is used, the (M1) should be awarded only for correct expansion and correct substitution into the formula.*

[12]

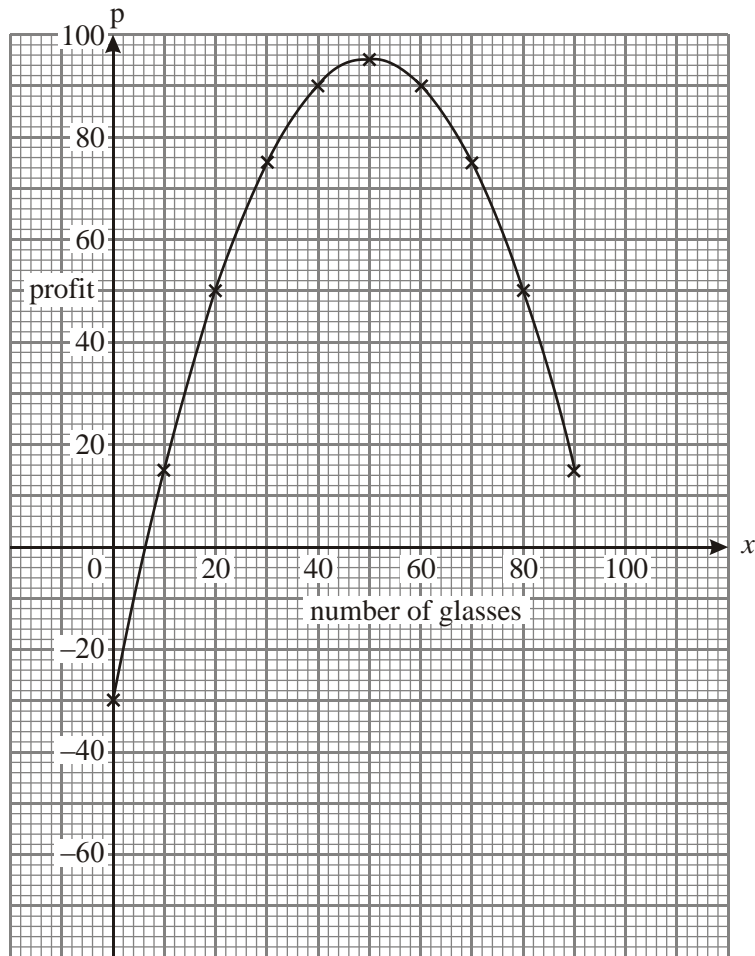
21. (a) (A3)

x	0	10	20	30	40	50	60	70	80	90
P	-30	15	50	75	90	95	90	75	50	15

Note: Award 1/2-mark for each correct bold entry, and round down.

If a candidate obtains (A0) here but has clearly shown the method of substituting in the values of x into the formula award (M1)

(b)



(A2)(A2)(A1)

Note: For graph, follow through from candidate's table

Notes: Award (A2) for axes, (A2) for plotting points and (A1) for a smooth curve.

Axes: Award 1/2-mark for each of the following and then round down:

horizontal axis labelled with "x" or "Numbers of glasses..."

vertical axis labelled with "P" of "Profit"

horizontal scale → consistent and presents values 0→90

vertical scale as for horizontal but represents their range of values for P.

Points: Award (A2) for 0 or 1 error

Award (A1) for 2 or 3 errors

Award (A0) otherwise

- (c) (i) maximum profit = 95 swiss francs (A1)
(ii) 50 glasses (A1)
(iii) 67 ± 2 (A1)
 33 ± 2 (A1)
(iv) 30 swiss francs (A1)

Note: Award no marks for -30 swiss francs

Note: Follow through from candidate's graph

(d) Fiona's share = $\frac{3}{6}$ (M1)

Profit from 40 glasses = 90 swiss francs

Fiona's profit = $\frac{1}{2} \times 90$
= 45 (A1)

[15]