Summer 2021

Rewarding Learning

Summer 2021
Alternative Arrangements: GCSE Additional Support
Mathematics: Support Papers 2 Solutions

Version 1.0

Rewarding Learning

General Certificate of Secondary Education
Summer 2021

GCSE Mathematics

ADDITIONAL SUPPORT MATERIALS 2
(For use in Summer 2021)

Solutions

GCSE MATHEMATICS 2021

The following solutions are from archived GCSE Past Papers and could be used to help teachers form judgements to provide supporting evidence in awarding Centre Determined Grades. They have **not** been compiled to be used as tests for students.

11 (a) (i) $63 - 48 = 15$ **MA1**

(ii) using 120/360 **M1**
$120/360 \times \pi \times 63^2 - 120/360 \times \pi \times 15^2$ **M1A1**
$4156.327081 - 235.619449 = 3920(.707632)$ **A1**

(b) $(8160 - 3920(.707632))/ 8160 \times 100 = 51.95$ **M1A1**

(c) 2 4 6 8…… and 1.5 3 4.5 6.….
6 **A1**

16 (a) $10x + 20y \leq 320$
$y \geq 11$
$y \leq 2x$ **A2**
[allow A1 for 2 correct]

(b) graph drawn with lines $10x + 20y = 320$ (through (0, 16) and (32, 0)),
$y = 11$ and $y = 2x$ and enclosed triangle indicated **M1A2**
[allow 1 mark for each of the three inequalities correctly indicated on the graph,
or 2 marks for the 3 lines with no indication of region]

(c) £2.80 No. of 10p coins 6 No. of 20p coins 11 **A1**

(d) £3.20 combinations 10 & 11 and 8 & 12 (10p and 20 p coins) **A2**
[allow 1 mark if £3.20 and 1 correct combination given]

12

Perpendicular bisector of XY drawn **M1A1**

14 x hens y cows
$x + y = 65$
$2x + 4y = 176$ **MA1**
$2x + 2y = 130$
$2y = 46$ $y = 23$ **MA1**
$x = 42$ **MA1**

15

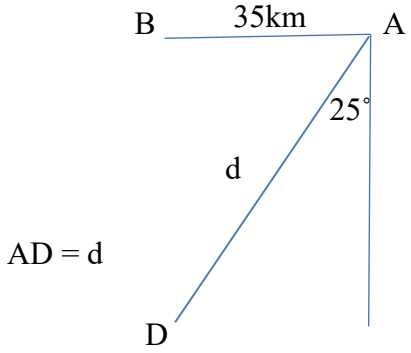

Diagram **MA1**

MA1

sin 25° = 35/d or cos 65° = 35/d
d = 35/sin 25° or d = 35/cos 65° **MA1**
d = 82(.81705541) **A1**

13

(a) (i) ½ x 4/3 x π x $(1.3)^3$ = 4.60138604 **MA1**
π x $(1.3)^2$ x (11.3 – 1.3) = 53.09291585 **MA1**
total = 57.69430189 **A1**
(ii) ½ x 4 x π x $(1.3)^2$ = 10.61858317 **MA1**
2 x π x (1.3) x (11.3 – 1.3) = 81.68140899 **MA1**
Total = 92.9999216 **A1**
(b) volume = π x $(1.3)^2$ x 2.4 = 12.7422998 **M1A1**

14

(a) (i) rectangle = 11 x $3x$ = $33x$
4 quarter circles = πx^2 = $22\,x^2/7$ **MA1**
$33x - 22x^2/7$ = 66 **MA1**
$3x - 2x^2/7$ = 6
$21x - 2x^2$ = 42
$2x^2 - 21x + 42$ = 0 **A1**
(ii) x = $(21 \pm \sqrt{(21^2 - 4 \times 2 \times 42)})/4$ **M1**
= 2.7 **A1**
[other answer too large, bigger than 11]
(b) $33y - 22y^2/7$ = $(33y)/2$ (half of rectangle) **M1**
$3y - 2y^2/7$ = $(3y)/2$
$42y - 4y^2$ = $21y$
$21y$ = $4y^2$ **MA1**
y = 5.25 **A1**

15

(a) 40/360 x π x 24^2 + 60/360 x π x 24^2 + 40/360 x π x 24^2
OR 140/360 x π x 24^2 **M1A1**
[allow 1 mark for correct use of fractions]
703.36 [allow variations for π values] **A1**
(b) 6 radii = 6 x 24 = 144 **MA1**
40/360 x 2π x 24 + 60/360 x 2π x 24 + 40/360 x 2π x 24
OR 140/360 x 2π x 24
58.6133…. [using 3.14] or 58.64306287 [using π] **M1A1**
(144 + 58.6….)/100 = 2.0 m **A1**

17 (a) 3 **A1**

(b) $F = (1/2)^t$ **A1**

(c) sketch roughly passing through
(1, 1/2), (2, 1/4), (3, 1/8), (4, 1/16), (5, 1/32), (6, 1/64) **M1A1**
and close to but not touching the F axis **MA1**

17 (a) all 1 square in one direction and two squares in other direction **MA1**
[accept similar explanation]

(b) (i) $\sqrt{5}$ **A1**

(ii) $\sqrt{2}$ **A1**

(iii) $\sqrt{18}$ or $3\sqrt{2}$ **A1**

(c) (i) $\sqrt{5} \times \sqrt{5} = 5$ **A1**

(ii) $\frac{1}{2} \times \sqrt{2} \times 3\sqrt{2} = 3$ **A1**

5 x (2p) and y (5p)

$2x + 5y = 82$

$5x + 2y = 100$ **MA1**

$4x + 10y = 164$ or $10x + 25y = 410$

$25x + 10y = 500$ or $10x + 4y = 200$ **MA1**

$2x = 336$ or $21y = 210$

$x = 16$ or $y = 10$ **A1**

$y = 10$ or $x = 16$ **A1**

12 (a) (i) angles in same sector or each = 65° (half angle at centre) **A1**

(ii) OXA, OYB isosceles (radii) so BYA = XBY = 65° or XAY = AXB = 65°
So lines parallel (alternate angles) **A1**

(iii) AXY (or BYX) = $90^\circ - 65^\circ = 25^\circ$ since BXY or BYA = 90° (semicircle) **MA1**
So ZXY or ZYX = $90^\circ - 25^\circ = 65^\circ$ (tangent at 90°)

So XZY = $180^\circ - 65^\circ - 65^\circ = 50^\circ$ **A1**

(b) (i) CBD = 20° (same sector) **A1**

(ii) ABD = 60° (angle in semicircle is 90°)
So ACD = $180^\circ - 60^\circ = 120^\circ$ (cyclic quadrilateral) **A1**

(iii) $180^\circ - (20^\circ + 30^\circ) - 120^\circ = 10^\circ$ **A1**

14 $3.14r^2 + 3.14 \times r \times 20 = 314$ **MA1**

$r^2 + 20r - 100 = 0$ **MA1**

$r = (-20 \pm \sqrt{(400 + 400)})/2 = 4.142\ldots$ (can't be negative) **M1A1**

5 (a) 36 **A1**

(b) $27 \times (2/3)^2 = 12$ **M1A1**
[allow 1 mark for using $(2/3)^2$ or $(1.5)^2$]

(c) using $(2/3)^3$ or $(1.5)^3$ **M1**

$135/(1.5)^3 = 40$ **M1A1**

6 (i) rotation of 90° clockwise, about (1, 1) **A1A1**
[accept reflection in $y = x$]
(ii) rotation of 90° anticlockwise, about (0, 0) **A1A1**
(iii) enlargement scale factor 2, using centre (0, 1) **A1A1**

9 $3a + 2b = 42$
$a + 3b = 35$ **MA1**
$3a + 9b = 105$ or $9a + 6b = 126$
$2a + 6b = 70$ **MA1**
$7b = 63$ so $b = 9$ or $7a = 56$ so $a = 8$ **A1**
$a = 8$ or $b = 9$ **A1**

12 (a) yes no yes no yes yes **A2**
Check if exterior angle (180° – interior) divides into 360° **A1**
(b)(i) interior angle 360° – (90° + 60° + 90°) = 120° **M1**
6 sides **A1**
(ii) interior angle = 90° + 60° = 150° **M1**
12 sides **A1**

13 (a) $AC^2 = (3\sqrt{6})^2 - 6^2$ **MA1**
$= 54 - 36 = 18$ **A1**
$AC = 3\sqrt{2}$ **A1**
(b) $\cos B = 6/3\sqrt{6}$ **M1**
$= (\sqrt{6})/3$ or $\sqrt{2}/\sqrt{3}$ **A1**

14 (a) (8 x 8 x 8) = 512 **A1**
(b) $0.01 = 1/10^2$ **M1**
– 2 **A1**

16 (a) $I = K/d^2$ **MA1**
$250 = k/3600$ so $k = 900000$ **MA1**
$I = 900000/d^2$ **A1**
(b) $62.5 = 900000/d^2$ **M1**
$d^2 = 14400$
$d = 120$ **A1**

13 (a) (i) 59 **A1**
(ii) 118 **A1**
(b) (i) 70 **A1**
(ii) 60 **A1**
(iii) 70 – 60 or ½(180 – 160) **M1**
10 **A1**

15 (a) (i) $x^2 = (x-1)^2 + (x-8)^2$ **M1**

$x^2 = x^2 - 2x + 1 + x^2 - 16x + 64$

$x^2 - 18x + 65 = 0$ **A1**

(ii) $(x-13)(x-5) = 0$ **M1**

$x = 5$ or 13 **A1**

(iii) AB = 13 since BD can't be negative (5 – 8) **A1**

(b) AC = y DC = $\frac{1}{2}y + 3$ AD = 12 **MA1**

$y^2 = (\frac{1}{2}y + 3)^2 + 12^2$ **MA1**

$y^2 = y^2/4 + 3y + 9 + 144$

$3y^2/4 - 3y - 153 = 0$ **MA1**

$y = (3 \pm \sqrt{(9 + 459)})/(2 \times \frac{3}{4}) = 16.42$ **M1A1**

16 (a) as x increases E increases, so not inverse variation **MA1**

(b)(i) not as x (4 value not twice 2 value)

$E = kx^2$ $640 = 4k$ $k = 160$ **M1**

(check $1440 = 160 \times 9$ or $2560 = 160 \times 16$)

$E = 160x^2$ **A1**

(ii) $E = 160 \times 5^2 = 4000$ **MA1**

$7840 = 160 \times x^2$ $x^2 = 49$ $x = 7$ **M1A1**

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