

# REVISE

*.wales*

## 3.10 – Rates of change, area under graph & trapezium rule

*Mark schemes for the 3.10 question pack*

*Spec 2.5.3, 2.5.4, 2.5.5 – Unit 3*

SOLUTIONS · 2025 SPECIFICATION

*Mark schemes for the 11 questions in the corresponding revise.wales question pack (52 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.*

<p>5(a) Axes labelled appropriately, e.g. (total) cost and (number of) people, <b>AND</b> uniform number of people scale from 20 (or less) to at least 80</p> <p>Reasonable uniform total cost scale from 500 (or less) to at least 1700</p> <p>Correct representation of the total cost for between 20 and 80 people</p>	<p>B1</p> <p>B1</p> <p>B2</p>	<p>Allow people and costs on either axis Allow '£' for costs</p> <table border="1" data-bbox="834 416 1361 477"> <tr> <td>People</td> <td>20</td> <td>40</td> <td>60</td> <td>80</td> </tr> <tr> <td>Cost £</td> <td>500</td> <td>900</td> <td>1300</td> <td>1700</td> </tr> </table> <p>FT 'their scale' if possible Ignore showing for less than 20 people (and up to 100 people) May be indicated by an appropriate straight line from 20 to 80 people (£500 to £1700) B1 for any 2 correct points given (indicated in working or plotted) OR B1 for all points (indicated in working or plotted), within the range 20 to 80 people inclusive, with a gradient of 20</p>	People	20	40	60	80	Cost £	500	900	1300	1700
People	20	40	60	80								
Cost £	500	900	1300	1700								
<p>5(b) <math>P = 20 + \frac{100}{N}</math> or equivalent</p>	<p>B3</p>	<p>Mark final answer B2 for <math>20 + 100/N</math> or <math>P = \dots + 100/N</math> B1 for sight of <math>100/N</math></p>										
<p>5(c) <math>(2240 - 200) \div 20</math> 102 (people)</p>	<p>M1 A1</p>	<p>Full method may be shown in stages</p>										

1320	ISW		
18. Sight of (0), 1, 4, 9, 16, 25 and 36. Split into 6 areas AND attempt to add derived areas  Correct substitution into trapezium rule. Area = $\frac{1}{2} [0 + 36 + 2(1 + 4 + 9 + 16 + 25)]$  - 72	✓ ✓  ✓  ✓	B1 M1  M1  A1	Penalise -1 once only for a <u>consistent</u> misreading of one scale.  If using 6 separate areas, at least one area calculation (for a trapezium) should be potentially correct. 1st M1 may be implied by correct use of formula. Or equivalent (0·5+2·5+6·5+12·5+20·5+30·5) F.T. 'their values of y' provided at least 2 correct. Allow 1 slip e.g. in a y-value term, in h, or in an individual area.





9.(a) $\tan x = \frac{6.4}{8.2}$ $(x =) \tan^{-1} 0.78(0..)$ or $\tan^{-1} \frac{6.4}{8.2}$ $= 38(^{\circ})$ OR $37.9(...^{\circ})$	M1 A1 A1	Implies previous A1.
<u>Alternative method.</u> <b>Correct use of 'two-step' method.</b> $(x) = 38(^{\circ})$	M2 A1	<i>A partial trigonometric method is M0.            Accept an answer that rounds to 38(^{\circ})</i>
9.(b) $(PAQ = 90 - 38 =) 52(^{\circ})$ $AQ = \frac{7.9}{\sin 52(^{\circ})}$  $(AQ) = 10(\text{cm})$ OR $10.0(...\text{cm})$	B1 M2  A1	FT $90^{\circ} -$ 'their $38^{\circ}$ '. May be seen on the diagram. FT 'their clearly defined PAQ' BUT <u>not</u> if PAQ = 'their x'.  M1 for $\sin 52(^{\circ}) = \frac{7.9}{AQ}$
<u>Alternative method.</u> $PQA = 38(^{\circ})$ $AQ = \frac{7.9}{\cos 38(^{\circ})}$  $(AQ) = 10(\text{cm})$ OR $10.0(...\text{cm})$	B1 M2  A1	FT 'their $38^{\circ}$ '. May be seen on the diagram. FT 'their clearly defined PQA'  M1 for $\cos 38(^{\circ}) = \frac{7.9}{AQ}$
<u>Alternative method.</u> $(PAQ = 90 - 38 =) 52(^{\circ})$ <b>Correct use of 'two-step' method.</b>  $(AQ) = 10(\text{cm})$	B1 M2  A1	FT $90^{\circ} -$ 'their $38^{\circ}$ '. <i>A partial trigonometric method is M0.            FT 'their clearly defined PAQ'            BUT <u>not</u> if PAQ = 'their x'.</i>  Accept an answer that rounds to 10(cm)

<p>16. (Area=) <math>\frac{1}{2} \times [18+0+2(20+20+18+14+8)]</math></p> <p style="text-align: right;">= 89</p>	<p>M2</p> <p>A1</p>	<p>Award M1 for 5 or more values correct and up to 1 incorrect OR all values correct but <math>h</math> incorrect.            FT from M1.            Condone <math>89^2</math> if offered as the final answer.</p>
<p><u>Alternative method:</u></p> $\frac{(18+20)}{2} + \frac{(20+20)}{2} + \frac{(20+18)}{2} + \frac{(18+14)}{2} + \frac{(14+8)}{2} + \frac{(8+0)}{2}$ <p>(Individual areas are: 19, 20, 19, 16, 11, 4.)</p> <p style="text-align: right;">= 89</p>	<p>M2</p> <p>A1</p>	<p>Each area may be seen as the sum of the area of a rectangle and a triangle.            M1 for the correct calculation for any 4 trapezia (not necessarily added together) OR if an incorrect <math>h</math> is used throughout.            FT from M1.            Condone <math>89^2</math> if offered as the final answer.            Treat splitting area into 12 parts as MR-1.</p>

<p>14.(a) <math>x = 0.4757575\dots</math> <math>100x = 47.5757575\dots</math> <u>with an attempt to subtract</u></p> <p style="text-align: center;"><math>471/990</math> or <math>157/330</math> ISW</p>	<p>M1</p> <p>A1</p>	<p>Or correct values <math>1000x</math> and <math>10x</math>, or equivalent. M0 for use of <math>x = 0.475475475\dots</math></p> <p>An answer of <math>47.1/99</math> gains M1 only.</p>
<p><u>Alternative method</u>  <math>(0.4 + 0.07575\dots) \frac{4}{10} + \frac{75}{990}</math> or equivalent  <math>\frac{471}{990}</math> or equivalent ISW</p>	<p>M1</p> <p>A1</p>	
<p>14.(b) <math>\frac{1}{8}</math></p>	<p>B1</p>	
<p>15. <math>9 + 4\sqrt{5}</math></p> <p style="text-align: center;">(-) 2</p> <p style="text-align: center;"><math>7 + 4\sqrt{5}</math> AND irrational</p>	<p>B2</p> <p>B2</p> <p>B1</p>	<p>If not B2, award B1 for 3 or 4 correct terms within <math>4 + 2\sqrt{5} + 2\sqrt{5} + 5</math> or <math>4 + 2\sqrt{5} + 2\sqrt{5} + \sqrt{25}</math> (without subsequent correct collection of terms) (<math>4\sqrt{5}</math> is equivalent to 'two correct terms')</p> <p>B1 for (numerator of) <math>10\sqrt{5}</math> or          B1 for (denominator of) <math>5\sqrt{5}</math> or <math>\sqrt{125}</math> or          B1 for appropriate factorisation of both numerator and denominator          e.g. <math>\frac{\sqrt{5} \times \sqrt{100}}{\sqrt{5} \times \sqrt{25}}</math> or <math>\frac{\sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{4}}{\sqrt{5} \times \sqrt{5} \times \sqrt{5}}</math></p> <p>Mark final answer.          FT for equivalent difficulty (requiring collection of terms) AND either B2 awarded AND final answer is irrational.</p>
<p>16.(a) (Area=) <math>\frac{1}{2} \times 1 \times [16+0+2(15+12+7)]</math>          or equivalent  <math>= 42</math></p>	<p>M2</p> <p>A1</p>	<p>Award M1 if only one y-value incorrect.</p> <p>F.T. from M1.</p> <p>If no marks, SC1 for an answer of 420 (from mis-reading horizontal scale).</p>
<p><u>Alternative method</u>  <math>\frac{(16+15)}{2} + \frac{(15+12)}{2} + \frac{(12+7)}{2} + \frac{(7+0)}{2}</math></p> <p style="text-align: center;"><math>= 42</math></p>	<p>M2</p> <p>A1</p>	<p>Individual areas are: 15.5, 13.5, 9.5, 3.5.</p> <p>M1 if only one y-value incorrect          or          M1 for any 2 (out of 4) correctly evaluated areas (of a complete 'strip').</p> <p>(Each area of a trapezium may be seen as the sum of the area of a rectangle and a triangle.)</p> <p>F.T. from M1 (provided 4 'strips' considered).</p> <p>If no marks, SC1 for an answer of 420 (from mis-reading horizontal scale).</p>
<p>16.(b) 'Greater than' WITH valid reason          e.g. trapezium rule gives an underestimate in this case and increasing the number of strips improves accuracy;          less (shaded area) left out;          more of the area (under curve) included;          tops of strips are closer to the curve.</p>	<p>E1</p>	<p>Allow e.g. increasing the number of strips improves accuracy.</p>

<p>14. (Area) <math>\frac{1}{2} \times [12+0+2(12+10+6)]</math> <math>= 34</math></p>	<p>M2 A1</p>	<p>Award M1 for 4 or more values correct and up to 1 incorrect OR all values correct but <math>h \neq 1</math>. F.T. from M1 provided h is correct. Ignore units. Condone <math>34^2</math> if offered as a final answer.</p>
<p>14. <u>Alternative method:</u> (Area) <math>\frac{(12+12) \times 1}{2} + \frac{(12+10) \times 1}{2} + \frac{(10+6) \times 1}{2} + \frac{(6+0) \times 1}{2}</math> (= 12 + 11 + 8 + 3)  <math>= 34</math></p>	<p>M2 A1</p>	<p><math>\times 1</math> not required. Each area may be seen as the sum of the area of a rectangle and a triangle. M1 for the sum of these 4 areas with 1 error (may be repeated) in the substitution of these values.  Condone missing brackets for M2 or M1 provided subsequent working leads to the appropriate values.  F.T. from M1 provided h is correct. Ignore units. Condone <math>34^2</math> if offered as the final answer. Treat splitting area into 8 parts as MR-1. If no marks awarded, award SC1 for sight of 12, 11, 8 and 6 (not in a sum).</p>

<p>8. (Area =) <math>\frac{1}{2} \times 3 \times (1 + 3.4 + 2(3.2 + 5.4 + 6.2))</math></p> <p style="text-align: right;">= 51 (m<sup>2</sup>)</p> <p>(Volume of water =) <math>51 \times 1.2</math></p> <p style="text-align: right;">= 61.2 (m<sup>3</sup>)</p>	<p>M2</p> <p>A1</p> <p>m1</p> <p>A1</p>	<p>M1 for 1 slip in substitution of width values</p> <p>FT from M1</p> <p>FT 'their 51' provided M1 or M2 previously awarded Condone further multiplication by 2 for m1A0</p>
<p><u>Alternative method for the first 3 marks:</u></p> $\frac{(1 + 3.2) \times 3}{2} + \frac{(3.2 + 5.4) \times 3}{2} + \frac{(5.4 + 6.2) \times 3}{2} +$ $\frac{(6.2 + 3.4) \times 3}{2} \text{ or equivalent}$ $[6.3 + 12.9 + 17.4 + 14.4]$ <p style="text-align: right;">= 51 (m<sup>2</sup>)</p>	<p>M2</p> <p>A1</p>	<p>M1 for the sum of these 4 areas with one error (may be repeated) in the substitution of width values</p> <p>FT from M1</p>

<p>11(a) 100 days</p>	<p>B1</p>	
<p>11(b)  <math>\frac{1}{2} \times 40 \times (100 + 60 + 2(100 + 140 + 150 + 110))</math>  <math>= 23\,200</math>                  (Average depth of water <math>=</math>) <math>23\,200 \div 200</math>  <math>= 116</math> (ft)</p>	<p>M2                  A1                  m1                  A1</p>	<p>M1 for 1 slip in substitution of values OR                  M1 for 1 of the vertical readings omitted with all others correct                  May be implied in further working                  FT from M1 is available provided it comes from a calculation with no vertical readings omitted                  FT 'their 23 200' provided M1 or M2 previously awarded</p>
<p>11(b) <u>Alternative method:</u>  <math>\frac{(100 + 100) \times 40}{2} + \frac{(100 + 140) \times 40}{2} + \frac{(140 + 150) \times 40}{2} + \frac{(150 + 110) \times 40}{2} + \frac{(110 + 60) \times 40}{2}</math>  <math>[4000 + 4800 + 5800 + 5200 + 3400]</math>  <math>= 23\,200</math>                  (Average depth of water <math>=</math>) <math>23\,200 \div 200</math>  <math>= 116</math> (ft)</p>	<p>M2                  A1                  m1                  A1</p>	<p>M1 for the sum of these 5 areas with one error (may be repeated) in the substitution of values OR                  M1 for the sight of 5 correct areas with the intention to add them (possibly omitting one)                  May be implied in further working                  FT from M1 is available provided it comes from the sum of 5 areas                  FT 'their 23 200' provided M1 or M2 previously awarded                  If no marks awarded, the following SC marks can be awarded for work that involves summing the mean of the 2 heights on either side of each bar, and then dividing by 5 to give an answer of 116 (ft):                  SC3 for work detailed above with no errors in substitution leading to <math>580/5 = 116</math>                  or                  SC2 for work detailed above with only 1 error, either in substitution (may be repeated) OR in an answer to a calculation, to arrive at their answer, allowing truncation/rounding of their final answer                  or                  SC1 for work detailed above with at most 1 error in substitution AND at most 1 error in an answer to a calculation to arrive at their answer, allowing truncation/rounding of their final answer</p>
<p>11(c) Appropriate tangent drawn at the 60th day                  Difference in y <math>\div</math> difference in x                  Correctly evaluated gradient given in its simplest form and lies within the range 0.3 to 0.8 (ft/day) or equivalent</p>	<p>M1                  m1                  A1</p>	<p>Allow m1A0 if one difference has been incorrectly calculated                  Mark final answer                  Accept a correct proper fraction, decimal or percentage                  If they give a decimal answer, it needs to be correctly evaluated to at least 1 decimal place, rounded or truncated</p>

Unit 1: Higher Tier	Mark	Comments
<p>8.</p> <p>(Area =) <math>\frac{1}{2} \times 2 \times (0 + 8 + 2(3.6 + 5.4 + 7))</math></p> <p>OR <math>\frac{1}{2} \times 2 \times (8 + 7.2 + 10.8 + 14)</math> or equivalent</p> <p style="text-align: right;">= 40 (m)</p> <p>(Total time for Sian =) <math>\frac{100 - 40}{8} (+8)</math> or equivalent</p> <p style="text-align: right;">= 15.5 (seconds)</p>	<p>M2</p> <p>A1</p> <p>m1</p> <p>A1</p>	<p>Ignore any additional areas for M2 or M1 M1 for 1 slip in substitution of vertical readings OR M1 for 1 of the vertical readings omitted with all others correct</p> <p>May be implied in further working e.g. the correct evaluation of the sum of the 4 areas together with an additional area FT from M1 is available provided it comes from a calculation with no vertical readings omitted</p> <p>FT 'their 40' provided M1 or M2 previously awarded</p> <p>Final answer of 7.5 (seconds) can be awarded m1A0 provided no incorrect work seen</p>
<p>8. <u>Alternative method for the first 3 marks:</u></p> <p><math>\frac{(0 + 3.6) \times 2}{2} + \frac{(3.6 + 5.4) \times 2}{2} + \frac{(5.4 + 7) \times 2}{2} + \frac{(7 + 8) \times 2}{2}</math></p> <p style="text-align: center;">[3.6 + 9 + 12.4 + 15]</p> <p style="text-align: right;">= 40 (m)</p>	<p>M2</p> <p>A1</p>	<p>Ignore any additional areas for M2 or M1 Each area may be seen as the sum of the area of a rectangle and a triangle M1 for the sum of these 4 areas with one error (may be repeated) in the substitution of vertical readings OR M1 for the sight of 4 correct areas with the intention to add them (possibly omitting one)</p> <p>May be implied in further working e.g. the correct evaluation of the sum of the 4 areas together with an additional area FT from M1 is available provided it comes from the sum of 4 areas</p>