

## L6 Mock Teacher Y 18-19 SOLUTIONS [48]

1.

(i)	$(2\sqrt{7})^2 = x^2 + (x+2)^2 - 2x(x+2)\cos 60$ $x^2 + 2x - 24 = 0$ $(x+6)(x-4) = 0$ $x = 4$	M1           A1           M1           A1           [4]	Attempt use of correct cosine rule           Obtain correct 3 term quadratic           Attempt to solve 3 term quadratic equation           Obtain $x = 4$ only           [4]	Must be attempt to use correct rule but allow BOD on lack of brackets eg $2\sqrt{7}^2$ not $(2\sqrt{7})^2$ , even if subsequently 14, and the same for the terms involving $x$ Allow omission of a square sign when substituting as long as correct formula has been seen No need to evaluate $\cos 60$ for M1 Evaluating in radian mode (-0.952) still can get M1 as long as $\cos 60$ seen first  Must be simplified to three terms but not necessarily all on one side of the equation  See additional guidance for valid methods  Must be from a correct solution of a correct quadratic, though only the positive root may ever be seen Could draw attention to required root by giving both answers and then eg underlining $x = 4$ A0 if $x = -6$ still present If the other root is stated, before being discarded, it must have been $x = -6$
(ii)	$\frac{1}{2} \times 4 \times 6 \times \sin 60$ $= 6\sqrt{3}$	M1           A1           [2]	Attempt area of the triangle, using their $x$           Obtain $6\sqrt{3}$           [2]	Must be using correct formula, including $\frac{1}{2}$ Allow equiv methods, such as $\frac{1}{2}bh$ as long as valid attempt at $b$ and $h$ Must be using a positive, numerical, value of $x$ from (i)  Must be given as simplified surd No ISW if then given as decimal, unless the exact value is indicated as the final answer (underlined etc)

2. (a) Evidence of  $f(2) = 0$  [M1]  
 $k = 30$  [A1]
- (b) Evidence of polynomial division [M1]  
 $15x^2 - 17x - 4$  [A1]
- (c)  $x = 2$  [A1]  
 $x = \frac{4}{3}$  [A1] oe  
 $x = -\frac{1}{5}$  [A1] oe

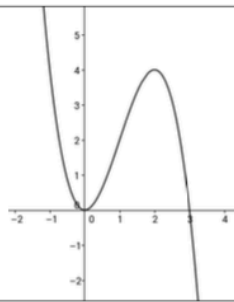
3. Attempt to find the roots of the quadratic [M1]  
 Roots are  $x = -1$  and  $x = \frac{5}{3}$  [A1]  
 Sketch of parabola: concave down passing through their roots [M1]  
 Dotted vertical line at  $x = 1$  to the right of the parabola's vertex [A1]  
 Correct region shaded [A1]

4.

3	$x^2 + (3x+4)^2 = 34$  $10x^2 + 24x - 18 = 0$ $5x^2 + 12x - 9 = 0$ $(5x-3)(x+3) = 0$ $x = \frac{3}{5}, x = -3$ $y = \frac{29}{5}, y = -5$	M1*  A1  M1dep*  A1  A1  [5]	Substitute for $x/y$ or valid attempt to eliminate one of the variables Correct three term quadratic in solvable form  Attempt to solve resulting three term quadratic  Correct $x$ values  Correct $y$ values	If $x$ eliminated:  $10y^2 - 8y + 290 = 0$ $5y^2 - 4y + 145 = 0$ $(5y-29)(y+5) = 0$  Award A1 A0 for one pair correctly found from correct quadratic  Spotted solutions: If M0 DM0 SC B1 $x = \frac{3}{5}, y = \frac{29}{5}$ www SC B1 $x = -3, y = -5$ www Must show on both line and curve (Can then get 5/5 if both found www and exactly two solutions justified)
---	---	--	---	---

5.

6.

7	(i)		<p><b>B1</b> Negative cubic with a max and a min</p> <p><b>B1</b> Cubic that meets y-axis at (0, 0) only</p> <p><b>B1</b> Double root at (0,0) and single root at (3, 0) and no other roots</p> <p>[3]</p>	For <b>first mark</b> must clearly be a cubic – must not stop at or before x axis, do not allow straight line sections drawn with a ruler/tending to extra turning points etc. Must not be a finite plot.
7	(ii)	$y = (x-2)^2(5-x)$ or $y = 3(x-2)^2 - (x-2)^3$	<p><b>M1</b> Translates curve by +2 or -2 parallel to the x-axis; must be consistent</p> <p><b>A1</b> Fully correct, must have “y =”.</p> <p>[2] <b>ISW</b> expansions</p>	e.g. for M1 $(x-2)^2(3-(x-2))$ but not $(x-2)^2(3-x-2)$
7	(iii)	Stretch Scale factor one-half parallel to the y-axis	<p><b>B1</b> <b>Must</b> use the word “stretch”</p> <p><b>B1</b> <b>Must</b> have “factor” or “scale factor”.</p> <p>[2] For “parallel to the y axis” allow “vertically”, “in the y direction”.</p>	Do <b>not</b> accept “in/on/across/up the y axis”. Allow second B1 after “squash” etc. but not after “translate” etc.

7. (a) Evidence of decreasing powers of 2: 64, 32, 16, 8 [M1] soi  
Evidence of increasing powers of  $(-3x)$  [M1] soi  
Evidence of correct coefficients: 1, 6, 15, 20 [M1] soi  
 $64 - 576x + \dots$  [A1]  
 $\dots + 2160x^2 - 4320x^3$  [A1]
- (b)  $4 \times \text{their } (-576)$  [M1]  
 $-144$  [A1]

8.

(i)	$(x-4)^2 - 16 + (y+1)^2 - 1 = 0$ $(x-4)^2 + (y+1)^2 = 17$ Centre = (4, -1) $m = -\frac{1}{4}$ $y = -\frac{1}{4}x$ $x + 4y = 0$	<p>M1 Correct method to find centre of circle</p> <p>A1 Correct centre soi.</p> <p>B1 Gradient of OA correct (could use OC or CA) [A = (8, -2) is not required for this part, but may be used]</p> <p>M1 Attempts equation of straight line through O or A or centre of the circle with their calculated gradient.</p> <p>A1 <b>www</b> Correct equation in required form i.e. <math>k(x+4y) = 0</math> for integer k, allow <math>0 = 4y + x</math> etc.</p> <p>[5]</p>	<p>e.g. <math>(x+4)^2</math> and <math>(y+1)^2</math> seen (or implied by correct answer)</p> <p><b>M</b> can be implied by correct centre.</p> <p>Note: Centre (-4, 1) leads to “correct” answer. <b>M1A0B0M1A0</b>  Max 2/5</p> <p><b>Alternative for first three marks:</b></p> <p><b>M1</b> Attempt at implicit differentiation as evidenced by <math>2y \frac{dy}{dx}</math> term</p> <p><b>A1</b> <math>2x + 2y \frac{dy}{dx} - 8 + 2 \frac{dy}{dx} = 0</math> and substitutes 0 to obtain <math>\frac{dy}{dx} = 4</math></p> <p><b>B1</b> Find correct negative reciprocal</p>
(ii)	A = (8, -2) $m' = 4$ $y + 2 = 4(x-8)$ When $y = 0, x = \frac{17}{2}$ Area = $\frac{1}{2} \times \frac{17}{2} \times 2 = \frac{17}{2}$	<p>B1ft Must be seen/used in (ii); ft their centre</p> <p>B1ft ft their gradient in (i)</p> <p>M1 Attempts equation of perpendicular line through their A. (<b>Not</b> (4, -1).)</p> <p>M1 Attempt to find x value of point B from their equation of perpendicular line</p> <p>M1 Attempt to find area of OAB e.g. <math>\frac{1}{2} \times</math> their OB <math>\times</math> their 2, or <math>\frac{1}{2} \times</math> their OA <math>\times</math> their AB, or split into two triangles</p> <p>A1 Accept 8.5 or equivalent fractions but not unsimplified surds. <b>www</b></p> <p>[6]</p>	<p>If centre used here, max <b>B1B1</b>, 2/6.</p> <p>Equation of line/B may not be seen explicitly.</p> <p>Must have used a valid method to find B. OA = <math>\sqrt{68}</math>, AB = <math>\sqrt{\frac{17}{4}}</math></p> <p>Look out for “correct” answer from wrong coordinates – <b>A0</b>.</p>