

WA6MNAUN3

Understanding number

Core + Challenge

Square Numbers — Marking Key

I can make square numbers as square arrays, recognise them and explain the patterns they make.

For tutors and parents. Award method marks for correct working even if the final answer is wrong.

Marks summary

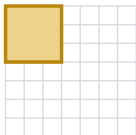
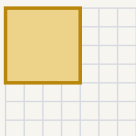
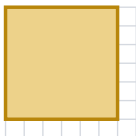
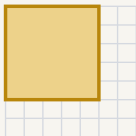
A Warm up: 16 B Practise: 20 C Think it through: 10 D Challenge: 9 **Total: 55**

Gold shading in this key shows what the child should have shaded or drawn. Accept any correct arrangement unless the question fixes it.

A

Warm up *answers*

/ 16 marks

Q	Answer	Model answer / notes	Marks
1	$3 \times 3 = 9$	3 rows of 3.	1
2	$5 \times 5 = 25$	5 rows of 5.	1
3	$2 \times 2 = 4$	2 rows of 2.	1
4	$7 \times 7 = 49$	7 rows of 7.	1
5	3 by 3 square	 $3 \times 3 = 9$.	1
6	4 by 4 square	 $4 \times 4 = 16$.	1
7	6 by 6 square	 $6 \times 6 = 36$.	1
8	5 by 5 square	 $5 \times 5 = 25$.	1
9	64	$8 \times 8 = 64$.	1

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Q	Answer	Model answer / notes	Marks
10	100	$10 \times 10 = 100$.	1
11	1	$1 \times 1 = 1$. Not 2 (1×2).	1
12	81	$9 \times 9 = 81$.	1
13	Yes, 7×7	$7 \times 7 = 49$.	1
14	No	It lies between 49 and 64.	1
15	Yes, 9×9	$9 \times 9 = 81$.	1
16	No	It lies between 9 and 16.	1

B

Practise *answers and working*

/ 20 marks

Q	Answer	Working / sample response	Marks																											
1	16, 25, 100	 <table border="1"><thead><tr><th>Pattern</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>10</th></tr></thead><tbody><tr><td>Dots</td><td>1</td><td>4</td><td>9</td><td>16</td><td>25</td><td>100</td></tr></tbody></table> a) Pattern 4 is a 4 by 4 square of 16 dots. b) Pattern n has $n \times n$ dots: 16, 25, and pattern 10 has $10 \times 10 = 100$. <i>1 mark: pattern 4 drawn (4 by 4).</i> <i>1 mark: 16 and 25.</i> <i>1 mark: 100.</i>	Pattern	1	2	3	4	5	10	Dots	1	4	9	16	25	100	3													
Pattern	1	2	3	4	5	10																								
Dots	1	4	9	16	25	100																								
2	Odd numbers	<table border="1"><thead><tr><th>Number</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr></thead><tbody><tr><td>Square</td><td>1</td><td>4</td><td>9</td><td>16</td><td>25</td><td>36</td><td>49</td><td>64</td></tr><tr><td>Difference</td><td></td><td>3</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td><td>15</td></tr></tbody></table> Squares: 1, 4, 9, 16, 25, 36, 49, 64. Differences: 3, 5, 7, 9, 11, 13, 15: the odd numbers, going up by 2 each time. <i>1 mark: 9, 25, 49.</i> <i>1 mark: all differences.</i> <i>1 mark: they are the odd numbers / go up by 2.</i>	Number	1	2	3	4	5	6	7	8	Square	1	4	9	16	25	36	49	64	Difference		3	5	7	9	11	13	15	3
Number	1	2	3	4	5	6	7	8																						
Square	1	4	9	16	25	36	49	64																						
Difference		3	5	7	9	11	13	15																						
3	a) 8 b) 36	a) $8 \times 8 = 64$, so 8 along each side. b) $10 \times 10 = 100$ pavers. $100 - 64 = 36$ more. <i>1 mark each part.</i>	2																											

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Q	Answer	Working / sample response	Marks																																																																																																				
4	10	<table border="1"><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr><tr><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td></tr><tr><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td></tr><tr><td>41</td><td>42</td><td>43</td><td>44</td><td>45</td><td>46</td><td>47</td><td>48</td><td>49</td><td>50</td></tr><tr><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td></tr><tr><td>61</td><td>62</td><td>63</td><td>64</td><td>65</td><td>66</td><td>67</td><td>68</td><td>69</td><td>70</td></tr><tr><td>71</td><td>72</td><td>73</td><td>74</td><td>75</td><td>76</td><td>77</td><td>78</td><td>79</td><td>80</td></tr><tr><td>81</td><td>82</td><td>83</td><td>84</td><td>85</td><td>86</td><td>87</td><td>88</td><td>89</td><td>90</td></tr><tr><td>91</td><td>92</td><td>93</td><td>94</td><td>95</td><td>96</td><td>97</td><td>98</td><td>99</td><td>100</td></tr></table> 1, 4, 9, 16, 25, 36, 49, 64, 81, 100. They are 1^2 up to 10^2, so there are 10. 1 mark: all ten shaded (no extras). 1 mark: 10.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	2
1	2	3	4	5	6	7	8	9	10																																																																																														
11	12	13	14	15	16	17	18	19	20																																																																																														
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81	82	83	84	85	86	87	88	89	90																																																																																														
91	92	93	94	95	96	97	98	99	100																																																																																														
5	a) 9 m b) 36 m	a) $9 \times 9 = 81$, so each side is 9 m. b) 4 sides $\times 9$ m = 36 m. 1 mark each part.	2																																																																																																				
6	a) 36, 49, 64 b) 81	a) $6^2 = 36$, $7^2 = 49$, $8^2 = 64$. b) 81 is 9 away from 90; 100 is 10 away. So 81 is closest. 1 mark: 36, 49 and 64. 1 mark: 81 with a reason.	2																																																																																																				
7	a) 16 b) 20	a) 25 dots in all, minus the $3 \times 3 = 9$ inside: $25 - 9 = 16$. b) $36 - (4 \times 4 \text{ inside}) = 36 - 16 = 20$, or 4 sides of 6 minus the 4 corners counted twice: $24 - 4 = 20$. 1 mark each part.	2																																																																																																				
8	See lines	<table><tr><td>5^2</td><td></td><td>100</td></tr><tr><td>7×7</td><td></td><td>25</td></tr><tr><td>3^2</td><td></td><td>9</td></tr><tr><td>10^2</td><td></td><td>49</td></tr></table> $5^2 = 25$, $7 \times 7 = 49$, $3^2 = 9$, $10^2 = 100$. 2 marks: all four. 1 mark: two or three. (Common error: $5^2 = 10$.)	5^2		100	7×7		25	3^2		9	10^2		49	2																																																																																								
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3^2		9																																																																																																					
10^2		49																																																																																																					
9	a) 7 b) Yes, 8 by 8	a) $7 \times 7 = 49$, so 7 rows of 7. b) $49 + 15 = 64 = 8 \times 8$, so yes: 8 rows of 8. 1 mark: 7. 1 mark: yes, because $64 = 8 \times 8$.	2																																																																																																				

C

Think it through *sample answers and criteria*

/ 10 marks

Q	Answer	Working / sample response	Marks									
1	No, it is 36	Squared means multiply the number by itself : $6^2 = 6 \times 6 = 36$. Ben worked out $6 \times 2 = 12$ instead. <i>1 mark: disagrees, 36.</i> <i>1 mark: explains squared means a number times itself.</i>	2									
2	True	To grow a square you add one row and one column that share a corner dot. That L has two equal arms plus 1 corner: an even number + 1, which is always odd (3, 5, 7, ...). <i>1 mark: True.</i> <i>1 mark: explanation using the L-shape (2 equal arms + 1) or the pattern of odd differences.</i>	2									
3	Always	9: 1, 3, 9 (3 factors). 16: 1, 2, 4, 8, 16 (5). 36: 1, 2, 3, 4, 6, 9, 12, 18, 36 (9). Factors come in pairs, but in a square number one pair is the same number twice (6×6), so it is only counted once. <i>1 mark: Always, with three correct tests.</i> <i>1 mark: explains the repeated middle factor.</i>	2									
4	120	$81 = 9^2$, $100 = 10^2$, $144 = 12^2$. 120 is between $10^2 = 100$ and $11^2 = 121$, so it is not a square number. <i>1 mark: 120.</i> <i>1 mark: shows the others are squares or that 120 is between 100 and 121.</i>	2									
5	See table	<table><tr><td></td><td>Even</td><td>Odd</td></tr><tr><td>Square</td><td>16, 64</td><td>25, 49, 81</td></tr><tr><td>Not square</td><td>30, 18</td><td>15</td></tr></table> The odd square numbers (25, 49, 81) come from odd numbers: 5×5, 7×7, 9×9. <i>1 mark: all eight sorted (accept seven).</i> <i>1 mark: notices odd squares come from odd numbers (odd $\times$ odd is odd).</i>		Even	Odd	Square	16, 64	25, 49, 81	Not square	30, 18	15	2
	Even	Odd										
Square	16, 64	25, 49, 81										
Not square	30, 18	15										

D

Challenge *solutions and criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	$50 = 1 + 49 = 25 + 25$; $65 = 1 + 64 = 16 + 49$	50: try each square up to 25: $50 - 1 = 49 \checkmark$, $50 - 4 = 46$, $50 - 9 = 41$, $50 - 16 = 34$, $50 - 25 = 25 \checkmark$. 65: $65 - 1 = 64 \checkmark$, $65 - 4 = 61$, $65 - 9 = 56$, $65 - 16 = 49 \checkmark$, $65 - 25 = 40$, $65 - 36 = 29$. <i>1 mark: both ways for 50.</i> <i>1 mark: both ways for 65.</i> <i>1 mark: systematic checking shows there are no others.</i>	3

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Q	Answer	Working / sample response	Marks
2	a) 36 b) $4 \times \text{side} - 4$ c) 144	a) 4 sides of 10 = 40, but the 4 corners are counted twice: $40 - 4 = 36$. b) Multiply the side by 4, then subtract 4 for the corners (or side $\times$ side – inner square). c) $44 + 4 = 48$, $48 \div 4 = 12$, so the square is 12 by 12: 144 dots. <i>1 mark each part.</i>	3
3	14 and 30	3 by 3: nine 1×1 , four 2×2 , one 3×3 : $9 + 4 + 1 = 14$. 4 by 4: $16 + 9 + 4 + 1 = 30$. The answer is the sum of the square numbers: $1 + 4 + 9 (+ 16)$. <i>1 mark: 14.</i> <i>1 mark: 30.</i> <i>1 mark: notices the answers are sums of square numbers.</i>	3