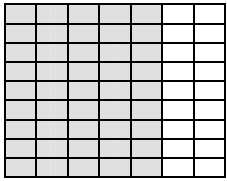


Proficient Level Procedures and Algorithms for Multiplication

	Third Grade	Fourth Grade	Fifth Grade																																		
Using Known Facts	<p>For 10×6</p> <p><i>use a known fact</i></p> <p>$5 \times 6 = 30$ So $10 \times 6 = 60$</p> <p>9×7</p>  <p>"I know $9 \times 5 = 45$"</p> <p>".....45 54 63"</p>																																				
Distributive Property of Multiplication over Addition	<p><i>breaking numbers apart by place</i></p> <p>$12 \times 6 = (10 \times 6) + (2 \times 6)$ $10 \times 6 = 60$ $2 \times 6 = 12$ $60 \times 12 = 72$ Like "big array small array" game</p> <p>$6 \times 32 = (6 \times 30) + (6 \times 2)$ $6 \times 30 = 180$ $6 \times 2 = 12$ $180 + 12 = 192$</p> <p><i>breaking numbers apart by addition</i></p> <p>$7 \times 8 = (5 \times 8) + (2 \times 8)$ $5 \times 8 = 40$ $2 \times 8 = 16$ $\underline{16}$ 56</p>	<p><i>breaking numbers apart by place</i></p> <p>$27 \times 4 = (10 \times 4) + (10 \times 4) + (7 \times 4)$ $10 \times 4 = 40$ $10 \times 4 = 40$ $7 \times 4 = 28$ $40 + 40 + 28 = 108$ Like "big array small array" game</p> <p>$42 \times 8 = (40 \times 8) + (2 \times 8)$ $40 \times 8 = 320$ $2 \times 8 = 16$ $320 + 16 = 336$</p> <p>36×24 $600 + 120 + 120 + 24 = 864$</p> <table border="1" data-bbox="1505 836 1854 974"> <tr> <td></td> <td>30</td> <td>+</td> <td>6</td> </tr> <tr> <td>20</td> <td>30×20</td> <td></td> <td>20×6</td> </tr> <tr> <td>+</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>30×4</td> <td></td> <td>4×6</td> </tr> </table> <p><i>breaking numbers apart by addition</i></p> <p>$27 \times 8 = (25 \times 8) + (2 \times 8)$ $25 \times 8 = 200$ $2 \times 8 = 16$ $\underline{16}$ 216</p>		30	+	6	20	30×20		20×6	+				4	30×4		4×6	<p><i>breaking numbers apart by place</i></p> <p>148×42 $40 \times 100 = 4000$ $40 \times 40 = 1600$ $40 \times 8 = 320$ $2 \times 100 = 200$ $2 \times 40 = 80$ $2 \times 8 = 16$ $4000 + 1600 + 320 + 200 + 80 + 16 = 6,216$</p> <table data-bbox="2016 868 2298 1161"> <tr> <td>148</td> <td>3</td> </tr> <tr> <td>$\times 42$</td> <td>11</td> </tr> <tr> <td>16</td> <td>148</td> </tr> <tr> <td>80</td> <td>$\times 42$</td> </tr> <tr> <td>200</td> <td>296</td> </tr> <tr> <td>320</td> <td><u>5920</u></td> </tr> <tr> <td>1,600</td> <td>6216</td> </tr> <tr> <td><u>4,000</u></td> <td></td> </tr> <tr> <td>6,216</td> <td>US Standard Notation</td> </tr> </table>	148	3	$\times 42$	11	16	148	80	$\times 42$	200	296	320	<u>5920</u>	1,600	6216	<u>4,000</u>		6,216	US Standard Notation
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Compensation or Transformation	<p><i>distributive property</i></p> <p>$9 \times 7 = (10 \times 7) - (1 \times 7)$ $10 \times 7 = 70$ $70 - 7 = 63$</p> <p><i>associative property</i></p> <p>12×4 $(6 \times 2) \times 4$ $6 \times (2 \times 4)$ $6 \times 8 = 48$</p>	<p><i>distributive property</i></p> <p>$89 \times 5 = (90 \times 5) - (1 \times 5)$ $90 \times 5 = 450$ $450 - 5 = 445$</p> <p><i>associative property</i></p> <p>35×6 $35 \times (2 \times 3)$ $(35 \times 2) \times 3$ $70 \times 3 = 210$</p>	<p><i>multiplicative identity and associative property</i></p> <p>32×9 $(32 \times 3) \times (9 \times 1/3)$ 96×3 $270 + 6$ 276</p> <p>180×3 $(180 \times 1/2) \times (3 \times 2)$ $9 \times 6 =$</p>																																		

Teachers may want to write the blue number sentences to help make the mathematics explicit for everyone. Students are not expected to write or state the blue expressions. This chart highlights the mathematics used in procedures and algorithms likely to be mastered by the end of each grade level. Students may use a variety of notation structures or models to demonstrate these strategies. Direct modeling and most counting strategies are not listed on this chart. Much of the work shown is completed mentally by students. Students do not need to write each step when solving every problem.