Age 11+ Level ★★
Worksheet 1 - Solutions

1. **The Square of My Age**
   Thom is 7 and Lauren is 13
   nrich.maths.org/7187/solution

2. **Square Triangle**
   Only one triangle has three angles that are all perfect squares:
   $10^2 + 8^2 + 4^2 = 180$
   nrich.maths.org/6221/solution

3. **Mini Cross-number**
   x = 4

2	7
6	4

   nrich.maths.org/10143/solution

4. **Tenth Power**
   (b) 3^{10} is odd and (c) 3^{10} is a square number, are both true
   nrich.maths.org/2218/solution

5. **Age of Augustus**
   Born in 1806
   nrich.maths.org/6747/solution

6. **Square Percentage**
   1%
   nrich.maths.org/11657/solution

7. **Maundy Money**
   Total was 2^{13}
   nrich.maths.org/6251/solution

These problems are adapted from UKMT (ukmt.org.uk) and WMC (competition.ac) problems.

Age 14+ Level ★
Worksheet 1 - Solutions

1. Pythagorean Quadruple
a, b and c are 2, 6, 9 since $2^2 + 6^2 + 9^2 = 121$
nrich.maths.org/7161/solution

2. Powers of Four
x = 15 since $4^{15} + 4^{15} + 4^{15} + 4^{15} = 4^{16}$
nrich.maths.org/5705/solution

3. Root 2017
$\sqrt{2017}$ is between 44 and 45
nrich.maths.org/13221/solution

4. Megabytes and Kilobytes
There are 1048576 bytes in a megabyte
nrich.maths.org/12812/solution

5. Power up to 1000
x = 3 and y = 3, so x + y = 6
nrich.maths.org/13711/solution

6. The Power of the Sum
n = 7 since $2^6 + 2^5 + 2^4 + 2^4 = 2^7$
nrich.maths.org/13711/solution

7. The Square and the Root
The remainder is 0
nrich.maths.org/13520/solution

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Age 14+ Level ★★
Worksheet 1 - Solutions

1. **Rooted Via 10**
   $4\sqrt{7}$ $5\sqrt{5}$ $6\sqrt{3}$
   nrich.maths.org/2510/solution

2. **Largest Expression**
   x^4 $<$ x^3 $<$ x^2 $<$ $x^3 + x^2$ $<$ $x^2 + x$
   nrich.maths.org/4985/solution

3. **Doubly Powerful**
   4^4 needs to be cubed, since $(4^4)^3 = 8^8$
   nrich.maths.org/11659/solution

4. **Huge Powers**
   6^{300} $<$ 3^{500} $<$ 2^{800} $<$ 5^{400}
   nrich.maths.org/12895/solution

5. **Roots Near 9**
   64 < n < 100, so there are 35 different possibilities for n
   nrich.maths.org/13713/solution

6. **Rough Root**
   2.2 is the closest
   nrich.maths.org/13596/solution

7. **Big Product**
   14 digits
   nrich.maths.org/13406/solution

8. **How Many Squares**
   68 numbers
   nrich.maths.org/13389/solution

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Age 14+ Level ★★
Worksheet 2 - Solutions

1. **Which Power**
   9, since $16^9 = 64^6$
   nrich.maths.org/13523/solution

2. **Cube Factors**
   7 perfect cubes
   nrich.maths.org/13233/solution

3. **Powerful Order**
   3^{11} < 8^8 < 2^{25}
   nrich.maths.org/7153/solution

4. **Two in a Million**
   2^6 is the highest power of 2
   nrich.maths.org/13575/solution

5. **Root Estimation**
   0.45 is closest
   nrich.maths.org/13394/solution

6. **Powerful Expression**
   8 x 4 x 2 < $2(4^3) - 2$ < $8^2 + 4^3$ < $2^7 + 2$
   nrich.maths.org/13578/solution

7. **The Power of x**
   x = 3, since $2^4 - 2^2 = 12$
   nrich.maths.org/13228/solution

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Age 14+ Level ★★★
Worksheet 1 - Solutions

1. **Know your Powers**
   xy = 3
   nrich.maths.org/12603/solution

2. **Self-power Squares**
   55 numbers
   nrich.maths.org/11625/solution

3. **Power of 3**
   ✦ = 672, since $3^{2016} + 9^{1008} + 27^{672} = 3^{2017}$
   nrich.maths.org/12464/solution

4. **Powered Up**
   pqrst = 2
   nrich.maths.org/10134/solution

5. **Power of Five**
   x = 3, since $5 (5^3 + 5^3 + 5^3 + 5^3 + 5^3)^2 = 5^9$
   nrich.maths.org/13726/solution

6. **Powerful 9**
   The last digit is 9
   nrich.maths.org/13220/solution

7. **Great Power**
   10^{250} is greater
   nrich.maths.org/13161/solution