The mathematics exercises are used to evaluate prospective participants of the NIST Office of Weights and Measures (OWM) Fundamentals of Metrology seminar because a minimum level of mathematics skills are required to be successful in the seminar. Successful completion of the exercises provides NIST OWM staff with a level of confidence that the prospective participant possesses those mathematical skills. Completed mathematical exercises are graded and feedback is provided to the prospective seminar participant so that refresher training can be obtained to bolster any weak areas that are identified. A metrologist, regardless of the specific measurement discipline, must perform a wide variety of mathematical calculations to provide their customer with a measurement result and uncertainty based on the measurement equation. The expectation of a metrologist is that they provide the correct answer 100 % of the time. To successfully complete the mathematics exercises and achieve approval to participate in the Fundamentals of Metrology Seminar, the participant must achieve a score of at least 70 % correct.

The mathematics exercises evaluate skills in the following areas:

- Orders of Operations, Powers and Roots
- Positive and Negative Numbers
- Metrology Related Examples (using typical measurement equations and variables)
- Units, Conversions and related Problems.

Each of these skills are extremely important to the field of metrology.

Mathematical Exercises **Name:**_____

Do not round answers.

Show your work!

Problems are to be submitted in either hand written or MSExcel workbook (any version) form. MSExcel is preferred to Val.Miller@nist.gov. Title the workbook file:{Your name} Balance Math Exercises {Date}.
Return the completed exercises by e-mail with the subject line "Balance Math Exercises" to aid in tracking your message.

Order of Operations, Powers & Roots

Reminder: PEMDAS

1. $10.1+3\times12-6.5=$_____

2. $6+18\div3+3^2=$_____

3. $9+24.3/8-5.2=$_____

4. $(9+24)/(8-5)=$_____

5. $56.6\div2+6\times5.2-7=$_____

6. $13+36\div4+2\times3=$_____

7. $48\div(2\times3)+2^3=$_____

8. $3.25\,(7-5\times2+6)=$_____

Positive and Negative Numbers

9. $5\times[(-7)-5+6]=$ _____

10. $-3.25(7-5\times2+6)=$ _____

11. $17\left(-\frac{1}{51}\right)=$_____

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12. $-12.25\left[3+(-2)\times\frac{1}{4}\right]=$_____

13. $3\times(4\times-3)=$_____

14. $-\frac{1}{(7-5\times2+6)}=$_____

Powers and Roots

15. $0.2^2=$ _____

16. $(0.000689)^2=$ _____

17. $15^2=$ _____

18. $(0.04)^{1/2}=$ _____

19. $\left(\frac{1}{2}\right)^2=$ _____

20. $\sqrt{16+9}=$_____

21. $\frac{1}{10^3}=$_____

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Units, Conversions, and Related Problems

Use conversion factors from NIST Special Publication 811 (attached).

Use exact conversion factors.

Mass **Note: 1 µg = 0.000 001 g = 1E-6 g = 1E-9 kg**

22. 100 g + 20 mg = _____ g

23. 100 g + 20 mg = _____ mg

24. 28.34952 g = _____ kg

25. 1237 mg = _____ g

26. 2.5 kg = _____ g

Temperature (Rewrite equation 3 to solve for ºF where necessary).

Equation 3

$$°C = \frac{°F - 32}{1.8}$$

27: 20 ºC =_____ ºF

28: 60 ºF =_____ ºC

Time taken to complete math exercises (including spreadsheet): _____ minutes