Examples 8 in The Radix

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Examples 8 in The Radix

Using the base specified, find the product of the numbers in each of the problems.

Example:
Suppose we do 8 x 3 on the base 9. Then, 8 and 3 are on base 9, and we get their product on the base 9, too.
$(8 \times 3)_{[9]} = 8_{[9]} \times 3_{[9]} = 24 = 18 + 6 = 2 \times 9^1 + 6 \times 9^0 = 26_{[9]}$.

0. $(3 \times 2)_4$ **1**. $(4 \times 5)_7$ **2**. $(12 \times 5)_8$

3. $(32 \times 4)_6$ **4.** $(34 \times 32)_5$ **5.** $(42 \times 46)_7$

6. $(34 \times 23)_{12}$ **7.** $(42 \times 64)_7$ **8.** $(0.3 \times 2)_4$

9. $(0.4 \times 5)_7$ **10.** $(1.2 \times 5)_8$ **11.** $(0.34 \times 3)_5$

12. $(3.2 \times 0.4)_6$ **13.** $(0.42 \times 0.64)_7$

14. $(0.362 \times 2.35)_8$

Suggestions or Solutions
To the Problem 0

$(3 \times 2)_4$

Note that in this example set, the numbers in **bold** face are in decimal. For example, **83** = $83_{[10]}$, but 83 = $83_{[9]}$ if the numbers are on the base 9.

We know **4** = 10 on the base 4.

3 x 2 = **6** = **4** + **2** = 10 + 2 = 12.

So we get $(3 \times 2)_4 = 12_4$.

Suggestions or Solutions
To the Problem 1

4 x 5 on the base 7

Note that in this example set, the numbers in **bold** face are in decimal. For example, **83** = $83_{[10]}$, but 83 = $83_{[9]}$ if the numbers are on the base 9.

7 = 10 on the base 7.

4 x 5 = **20** = **2 x 7 + 6** = 20 + 6 = 26.

So we get $(4 \times 5)_7 = 26_7$.

Suggestions or Solutions
To the Problem 2

$(12 \times 5)_8$

Note that in this example set, the numbers in **bold** face are in decimal. For example, **83** = $83_{[10]}$, but 83 = $83_{[9]}$ if the numbers are on the base 9.

8 = 10 on the base 8.
We cannot do this: 12 x 5 = 60 = 7 x **8** + 4 = 74.
That's because 12 is on the base 8.
The proper calculation is as follows.

12 x 5 = (10 + 2) x 5
= 10 x 5 + 2 x 5
= 5 x 10 + **10** [5 of 10 = 5 of **8**]
= 5 x 10 + **8** + **2**
= 5 x 10 + 10 + 2
= 6 x 10 + 2
= 62.

Suggestions or Solutions

To the Problem 3

$(32 \times 4)_6$

32 x 4

= (3 x 10 + 2) x 4

= **12** x 10 + **8** {**12**, **8**, and **6** are on the base 10.}

= 2 x **6** x 10 + **6** + 2

= 2 x 10 x 10 + 10 + 2

= 200 + 10 + 2 = 212.

So we get $(32 \times 4)_6 = 212_6$.

Suggestions or Solutions
To the Problem 4

$(34 \times 32)_5$

$(34 \times 32)_{[5]}$

$= (30 + 4)_5 \times (30 + 2)_5$

= (3 x 5 + 4) x (3 x 5 + 2) {From now on, all the numbers are decimal.}

= 19 x 17

= 190 + 19 x 7 = 190 + 70 + 63 = 190 + 133 = 323

= 5 x 64 + 3

= 5 x (5 x 12 + 4) + 3

= 5 x 5 x 12 + 4 x 5 + 3

= 5 x 5 x (5 x 2 + 2) + 4 x 5 + 3

= 5 x 5 x 5 x 2 + 2 x 5 x 5 + 4 x 5 + 3 {All the number have been decimal up to now.}

$= 2243_{[5]}$

And we can get the same the way as follows, too.

Note that 5 in decimal is 10 on the base 5, and that on the base 5, 10 x 10 is 5 x 5 in decimal.

34 x 32
= **9** x 100 + **6** x 10 + **12** x 10 + **8**
= (**5 + 4**)100 + (**5 + 1**)10 + (**5 x 2 + 2**)10 + **5 + 3**
= 5 x 100 + 4 x 100 + 5 x 10 + 10 + 2 x 5 x 10 + 2 x 10
+ 10 + 3
= 1000 + 4 x 100 + 100 + 10 + 2 x 100 + 2 x 10 **+** 10 + 3
= 1000 + 5 x 100 + 2 x 100 + 4 x 10 + 3
= 1000 + 1000 + 2 x 100 + 43
= 2243

Suggestions or Solutions
To the Problem 5

$(42 \times 46)_7$

42 x 46

= **16** x 100 + **24** x 10 + **8** x 10 + **12**

= (2 x **7** + 2)100 + (3 x **7** + 3)10 + (**7** + 1)10 + **7** + 5

= 2 x **7** x 100 + 2 x 100 + 3 x **7** x 10 + 3 x 10 + **7** x 10 + 10

+ **7** + 5

= 2 x 10 x 100 + 2 x 100 + 3 x 10 x 10 + 3 x 10 + 10 x 10 +

10 + **7** + 5

= 2000 + 200 + 300 + 30 + 100 + 10 + 10 + 5

= 2000 + 600 + 50 + 5

= 2655

So we get $(42 \times 46)_7 = 2655_7$.

Suggestions or Solutions

To the Problem 6

$(34 \times 23)_{12}$

12 = 10 on the base 12.

34 x 23 = 6 x 100 + 8 x 10 + 9 x 10 + **12**

= 600 + **17** x 10 + 10

= 600 + (**12** + 5) x 10 + 10

= 600 + **12** x 10 + 50 + 10

= 600 + 100 + 60

= 700 + 60

= 760.

So we get $(34 \times 23)_{12} = 760_{12}$.

Suggestions or Solutions
To the Problem 7

$(42 \times 64)_7$

42 x 64

= **24** x 100 + **16** x 10 + **12** x 10 + **8**

= **24** x 100 + **28** x 10 + **8**

= (3 x **7** + 3) x 100 + (4 x **7**) x 10 + **8**

= 3 x **7** x 100 + 3 x 100 + 4 x **7** x 10 + **7** + 1

= 3 x 10 x 100 + 3 x 100 + 4 x 10 x 10 + 10 + 1

= 3 x 1000 + 3 x 100 + 4 x 100 + 10 + 1

= 3000 + 700 + 10 + 1

= 3711

So we get $(42 \times 64)_7 = 3711_7$.

Suggestions or Solutions
To the Problem 8

$(0.3 \times 2)_4$

4 x 0.1_4 can mean that 4 of (0.1_4)s, where 0.1_4 is on the base 4.
Then, we can put 0.**4** in 1 on the base 4. Why?

That's because 0.**4** means 4 of 0.1_4 where 0.1_4 is still on the base 4. Note that 0.1 on the base 4 is 1/4 on the base 10. Then, we can use the setting above doing the multiplication in this problem. Thus, we can get this:

0.3 x 2 = **6** x 0.1 = (**4** + 2) x 0.1
= **4** x 0.1 + 0.2
= 10 x 0.1 + 0.2
= 1 + 0.2
= 1.2
So we get $(0.3 \times 2)_4 = 1.2_4$.

Suggestions or Solutions
To the Problem 9

$(0.4 \times 5)_7$

Since $0.1_7 = 1/7$ in decimal, we can set $0.\mathbf{7} = 1$ on the base 7 as in the problem 8 above.
It's because $0.\mathbf{7}$ has **7** of 0.1 on the base 7, and $0.1_7 = 1/7$ on the base 10. Thus, we can get this:

0.4×5

$= \mathbf{20} \times 0.1$

$= (2 \times \mathbf{7} + 6) \times 0.1$

$= 2 \times \mathbf{7} \times 0.1 + 0.6$

$= 2 \times 10 \times 0.1 + 0.6$

$= 2 \times 1 + 0.6 \quad \{10 = \mathbf{7}\}$

$= 2.6$

So we get $(0.4 \times 5)_7 = 2.6_7$.

Suggestions or Solutions

To the Problem A

$(1.2 \times 5)_8$

Setting 0.**8** = 1 on the base 8, we can get this:

1.2 x 5 = 5 + **10** x 0.1 {5 x 0.2 = 5 x 2 x 0.1 = **10** x 0.1}

= 5 + (**8** + 2) x 0.1

= 5 + **8** x 0.1 + 0.2

= 5 + 10 x 0.1 + 0.2

= 5 + 1 + 0.2

= 6.2

So we get $(1.2 \times 5)_8 = 6.2_8$.

Suggestions or Solutions
To the Problem B

$(0.34 \times 3)_5$

We can set $0.\mathbf{5} = 5 \times 0.1_5 = 1$ on the base 5 where $0.1_5 =$ 1/5 on the base 10 = 0.2 on the base 10. So setting 0.5 = 1 on the base 5, we can get this:

0.34 x 3

= **9** x 0.1 + **12** x 0.01

= (**5** + 4) x 0.1 + (2 x **5** + 2) x 0.01

= 0.5 + 0.4 + 2 x **5** x 0.01 + 2 x 0.01

= 1 + 0.4 + 2 x 10 x 0.01 + 0.02

= 1 + 0.4 + 2 x 0.1 + 0.02

= 1 + 0.4 + 0.2 + 0.02

= 1 + 0.**5** + 0.1 + 0.02

= 1 + 1 + 0.1 + 0.02

= 2.12

So we get $(0.34 \times 3)_5 = 2.12_5$.

Suggestions or Solutions
To the Problem C

$(3.2 \times 0.4)_6$

Setting 0.**6** = 1 on the base 6, and 0.0**6** = 0.1 on the base 6, we can get this:

3.2 x 0.4

=3.2 x 4 x 0.1

= (3 + 0.2) x 4 x 0.1

= **12** x 0.1 + 0.1 x 2 x 4 x 0.1

= 2 x **6** x 0.1 + **8** x 0.01

= 2 x 10 x 0.1 + (**6** + 2) x 0.01

= 2 x 1 + 0.06 + 0.02

= 2 x 1 + 0.1 + 0.02

= 2.12

So we get $(3.2 \times 0.4)_6 = 2.12_6$.

Suggestions or Solutions
To the Problem D

$(0.42 \times 0.64)_7$

0.42×0.64

$= \mathbf{24} \times 0.01 + \mathbf{16} \times 0.001 + \mathbf{12} \times 0.001 + \mathbf{8} \times 0.0001$

$= (3 \times \mathbf{7} + 3) \times 0.01 + 4 \times \mathbf{7} \times 0.001 + (\mathbf{7} + 1) \times 0.0001$

$= 3 \times 0.07 + 0.03 + 4 \times 0.007 + 0.0007 + 0.0001$

$= 3 \times 0.1 + 0.03 + 4 \times 0.01 + 0.001 + 0.0001$

$= 0.3 + 0.03 + 0.04 + 0.001 + 0.0001$

$= 0.3 + 0.07 + 0.001 + 0.0001$

$= 0.3 + 0.1 + 0.001 + 0.0001$

$= 0.4 + 0.001 + 0.0001$

$= 0.4011$

So we get $(0.42 \times 0.64)_7 = 0.4011_7$.

Suggestions or Solutions

To the Problem E

$(0.362 \times 2.35)_8$

0.362 x 2.35

= (0.3 + 0.06 + 0.002) x (2 + 0.3 + 0.05)

= 6 x 0.1 + **12** x 0.01 + 4 x 0.001 + **9** x 0.01 + **18** x 0.001

+ 6 x 0.0001 + **15** x 0.001 + **30** x 0.0001 + **10** x 0.00001

= 0.6 + (**12 + 9**) x 0.01 + (4 + **18** + **15**) x 0.001

+ (6 + **30**) x 0.0001 + **10** x 0.00001

= 0.6 + **21** x 0.01 + **37** x 0.001 + **36** x 0.0001 + **10** x 0.00001

= 0.6 + (2 x **8** + 5) x 0.01 + (4 x **8** + 5) x 0.001

+ (4 x **8** + 4) x 0.0001 + (**8** + 2) x 0.00001

= 0.6 + 2 x 0.0**8** + 0.05 + 4 x 0.00**8** + 0.005 + 4 x 0.000**8**

+ 0.0004 + 0.0000**8** + 0.00002

= 0.6 + 2 x 0.1 + 0.05 + 4 x 0.01 + 0.005 + 4 x 0.001
+ 0.0004 + 0.0001 + 0.00002

= 0.6 + 0.2 + 0.05 + 0.04 + 0.005 + 0.004 + 0.0004
+ 0.0001 + 0.00002

= 0.**8** + **9** x 0.01 + **9** x 0.001 + 5 x 0.0001 + 2 x 0.00001

= 0.**8** + (**8** + 1) x 0.01 + (**8** + 1) x 0.001 + 0.00052

= 1 + 0.0**8** + 0.01 + 0.00**8** + 0.001 + 0.00052

= 1 + 0.1 + 0.02 + 0.001 + 0.00052 {0.008 = 0.01}
= 1.12152

So we get $(0.362 \times 2.35)_8 = 1.12152_8$.