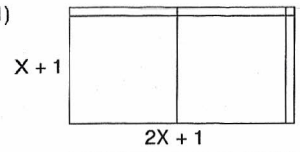
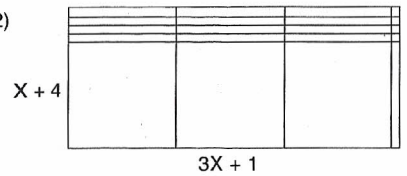
22A

1)



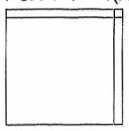
$$\begin{array}{r} 2X + 1 \\ \times \quad X + 1 \\ \hline 2X + 1 \\ 2X^2 + X \\ \hline 2X^2 + 3X + 1 \end{array}$$

2)



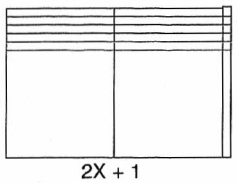
$$\begin{array}{r} 3X + 1 \\ \times \quad X + 4 \\ \hline 12X + 4 \\ 3X^2 + X \\ \hline 3X^2 + 13X + 4 \end{array}$$

3) $4X^2 + 8X + 4 = 4(X^2 + 2X + 1)$



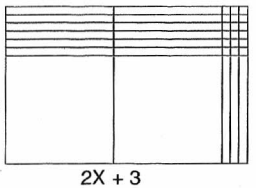
$$\begin{array}{r} X + 1 \\ \times \quad X + 1 \\ \hline X + 1 \\ X^2 + X \\ \hline X^2 + 2X + 1 \end{array}$$

4)



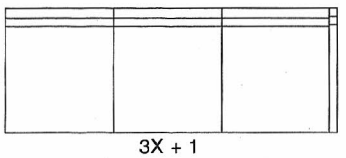
$$\begin{array}{r} 2X + 1 \\ \times \quad X + 5 \\ \hline 10X + 5 \\ 2X^2 + X \\ \hline 2X^2 + 11X + 5 \end{array}$$

5)



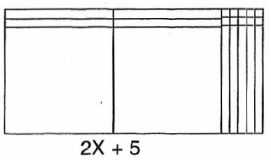
$$\begin{array}{r} 2X + 3 \\ \times \quad X + 6 \\ \hline 12X + 18 \\ 2X^2 + 3X \\ \hline 2X^2 + 15X + 18 \end{array}$$

6)



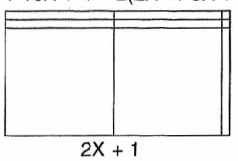
$$\begin{array}{r} 3X + 1 \\ \times \quad X + 2 \\ \hline 6X + 2 \\ 3X^2 + X \\ \hline 3X^2 + 7X + 2 \end{array}$$

7)



$$\begin{array}{r} 2X + 5 \\ \times \quad X + 2 \\ \hline 4X + 10 \\ 2X^2 + 5X \\ \hline 2X^2 + 9X + 10 \end{array}$$

8) $4X^2 + 10X + 4 = 2(2X^2 + 5X + 2)$



$$\begin{array}{r} 2X + 1 \\ \times \quad X + 2 \\ \hline 4X + 2 \\ 2X^2 + X \\ \hline 2X^2 + 5X + 2 \end{array}$$

9) $(2X + 3)(X + 3)$

Drawings for #9-16 are not shown. The student should continue to build the problems as illustrated at left.

$$\begin{array}{r} 2X + 3 \\ \times \quad X + 3 \\ \hline 6X + 9 \\ 2X^2 + 3X \\ \hline 2X^2 + 9X + 9 \end{array}$$

10) $(4X + 1)(X + 2)$

$$\begin{array}{r} 4X + 1 \\ \times \quad X + 2 \\ \hline 8X + 2 \\ 4X^2 + X \\ \hline 4X^2 + 9X + 2 \end{array}$$

11) $(3X + 4)(X + 2)$

$$\begin{array}{r} 3X + 4 \\ \times \quad X + 2 \\ \hline 6X + 8 \\ 3X^2 + 4X \\ \hline 3X^2 + 10X + 8 \end{array}$$

12) $2(X^2 + 7X + 10) = 2(X + 2)(X + 5)$

$$\begin{array}{r} X + 2 \\ \times \quad X + 5 \\ \hline 5X + 10 \\ X^2 + 2X \\ \hline X^2 + 7X + 10 \end{array}$$

13) $(2X + 1)(X + 3)$

$$\begin{array}{r} 2X + 1 \\ \times \quad X + 3 \\ \hline 6X + 3 \\ 2X^2 + X \\ \hline 2X^2 + 7X + 3 \end{array}$$

14) $(4X + 3)(X + 1)$

$$\begin{array}{r} 4X + 3 \\ \times \quad X + 1 \\ \hline 4X + 3 \\ 4X^2 + 3X \\ \hline 4X^2 + 7X + 3 \end{array}$$

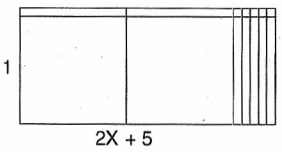
15) $(2X + 9)(X + 2)$

$$\begin{array}{r} 2X + 9 \\ \times \quad X + 2 \\ \hline 4X + 18 \\ 2X^2 + 9X \\ \hline 2X^2 + 13X + 18 \end{array}$$

16) $(3X + 4)(X + 3)$
(Check as above)

22B

1)

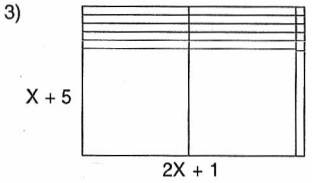


$$\begin{array}{r} 2X + 5 \\ \times \quad X + 1 \\ \hline 2X + 5 \\ 2X^2 + 5X \\ \hline 2X^2 + 7X + 5 \end{array}$$

2) $(5X + 2)(X + 3)$

$$\begin{array}{r} 5X + 2 \\ \times \quad X + 3 \\ \hline 15X + 6 \\ 5X^2 + 2X \\ \hline 5X^2 + 17X + 6 \end{array}$$

3)

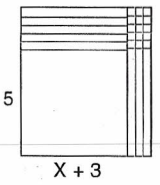


$$\begin{array}{r} 2X + 1 \\ \times \quad X + 5 \\ \hline 10X + 5 \\ 2X^2 + X \\ \hline 2X^2 + 11X + 5 \end{array}$$

4) $(4X + 1)(X + 3)$

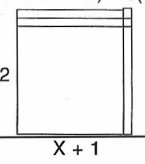
$$\begin{array}{r} 4X + 1 \\ \times \quad X + 3 \\ \hline 12X + 3 \\ 4X^2 + X \\ \hline 4X^2 + 13X + 3 \end{array}$$

5) $2(X^2 + 8X + 15) = 2(X + 3)(X + 5)$



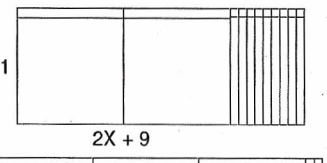
$$\begin{array}{r} X + 5 \\ \times \quad X + 3 \\ \hline 3X + 15 \\ X^2 + 5X \\ \hline X^2 + 8X + 15 \end{array}$$

6) $3(X^2 + 3X + 2) = 3(X + 1)(X + 2)$



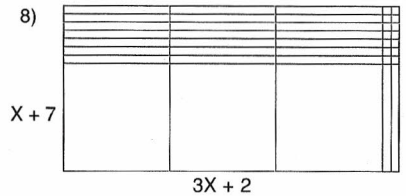
$$\begin{array}{r} X + 1 \\ \times \quad X + 2 \\ \hline 2X + 2 \\ X^2 + X \\ \hline X^2 + 3X + 2 \end{array}$$

7)



$$\begin{array}{r} 2X + 9 \\ \times \quad X + 1 \\ \hline 2X + 9 \\ 2X^2 + 9X \\ \hline 2X^2 + 11X + 9 \end{array}$$

8)



$$\begin{array}{r} 3X + 2 \\ \times \quad X + 7 \\ \hline 21X + 14 \\ 3X^2 + 2X \\ \hline 3X^2 + 23X + 14 \end{array}$$

9) $(2X + 3)(X + 5)$

The student should continue to build the problems as illustrated at left.

$$\begin{array}{r} 2X + 3 \\ \times \quad X + 5 \\ \hline 10X + 15 \\ 2X^2 + 3X \\ \hline 2X^2 + 13X + 15 \end{array}$$

10) $5(X + 7)(X + 3)$

$$\begin{array}{r} X + 7 \\ \times \quad X + 3 \\ \hline 3X + 21 \\ X^2 + 7X \\ \hline X^2 + 10X + 21 \end{array}$$

11) $6(X + 4)(X + 2)$

$$\begin{array}{r} X + 4 \\ \times \quad X + 2 \\ \hline 2X + 8 \\ X^2 + 4X \\ \hline X^2 + 6X + 8 \end{array}$$

12) $(3X + 8)(X + 2)$

$$\begin{array}{r} 3X + 8 \\ \times \quad X + 2 \\ \hline 6X + 16 \\ 3X^2 + 8X \\ \hline 3X^2 + 14X + 16 \end{array}$$

13) $2(2X + 1)(X + 3)$

$$\begin{array}{r} 2X + 1 \\ \times \quad X + 3 \\ \hline 6X + 3 \\ 2X^2 + X \\ \hline 2X^2 + 7X + 3 \end{array}$$

14) $(5X + 2)(X + 1)$

$$\begin{array}{r} 5X + 2 \\ \times \quad X + 1 \\ \hline 5X + 2 \\ 5X^2 + 2X \\ \hline 5X^2 + 7X + 2 \end{array}$$

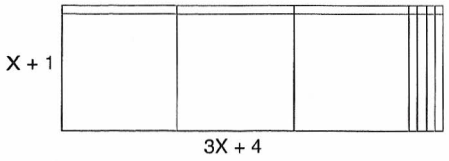
15) $(10X + 1)(X + 1)$

$$\begin{array}{r} 10X + 1 \\ \times \quad X + 1 \\ \hline 10X + 1 \\ 10X^2 + X \\ \hline 10X^2 + 11X + 1 \end{array}$$

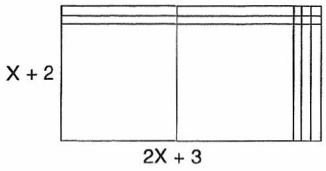
16) $(4X + 3)(X + 5)$
(Check as above)

22C

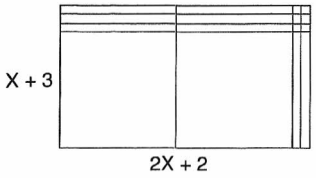
1) $(3X + 4)(X + 1)$



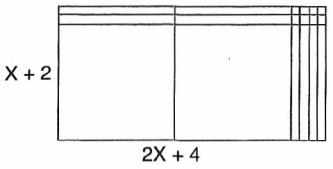
2) $(2X + 3)(X + 2)$



3) $2X^2 + 8X + 6$



4) $2X^2 + 8X + 8$



5) $(3X + 4)(X + 3)$

6)
$$\begin{array}{r} 3X + 4 \\ \times\ X + 3 \\ \hline 9X + 12 \\ 3X^2 + 4X \\ \hline 3X^2 + 13X + 12 \end{array}$$

7) $4(X^2 + 6X + 9) = 4(X + 3)(X + 3)$

8)
$$\begin{array}{r} X + 3 \\ \times\ X + 3 \\ \hline 3X + 9 \\ X^2 + 3X \\ \hline X^2 + 6X + 9 \end{array}$$

9) $(2X + 1)(2X + 3)$

10)
$$\begin{array}{r} 2X + 1 \\ \times\ 2X + 3 \\ \hline 6X + 3 \\ 4X^2 + 2X \\ \hline 4X^2 + 8X + 3 \end{array}$$

11) $B^{2+6-5} = B^3$

12) A^{B+C}

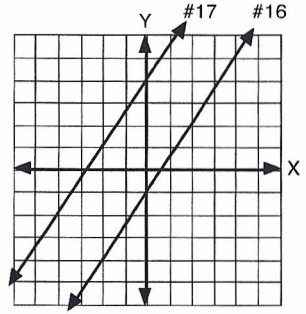
13) $X^{-3}Y^2X^{-1}Y^3X^5 = XY^5$

14) $A^3A^{-2}B^1B^2A^{-4} = A^{-3}B^3$

15) 6 x 1,000,000 + 8 x 10,000 + 2 x 1,000 + 7 x 1/100 = 6,082,000.07

16) $Y = 3/2\ X - 1$
see graph

17) $m = 3/2$
$(4) = 3/2(0) + b$
$b = 4$
$Y = 3/2\ X + 4$ or $3X - 2Y = -8$
see graph



18)

hrs	amoeba
1	2
2	4
3	8
4	16

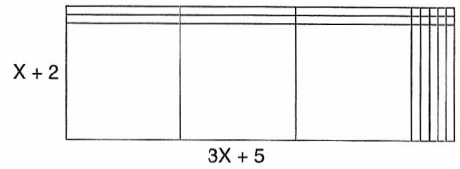
19)

hrs	amoeba
1	2^1
2	2^2
3	2^3
4	2^4

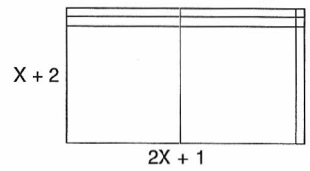
20) 6 hours = 2^6
X hours = 2^X

22D

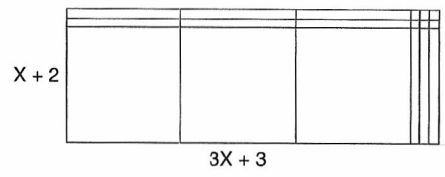
1) $(3X + 5)(X + 2)$



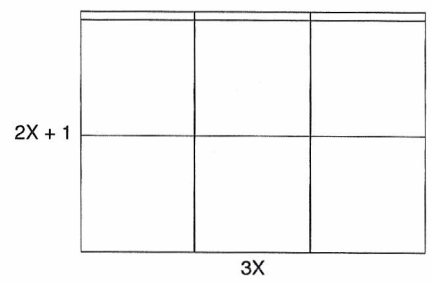
2) $2(2X^2 + 5X + 2) = 2(2X + 1)(X + 2)$



3) $3X^2 + 9X + 6$



4) $6X^2 + 3X$



5) $(3X + 5)(X + 1)$

6)
$$\begin{array}{r} 3X + 5 \\ \times\ X + 1 \\ \hline 3X + 5 \\ 3X^2 + 5X \\ \hline 3X^2 + 8X + 5 \end{array}$$

7) $(4X + 7)(X + 1)$

8)
$$\begin{array}{r} 4X + 7 \\ \times\ X + 1 \\ \hline 4X + 7 \\ 4X^2 + 7X \\ \hline 4X^2 + 11X + 7 \end{array}$$

9) $(X + 3)(X + 2)$

10)
$$\begin{array}{r} X + 3 \\ \times\ X + 2 \\ \hline 2X + 6 \\ X^2 + 3X \\ \hline X^2 + 5X + 6 \end{array}$$

11) $C^{-4+3+0} = C^{-1}$

12) $8^{5-3} = 8^2$

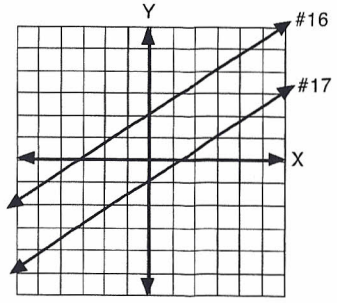
13) $B^5B^2C^{-5}B^4C^3 = B^{11}C^{-2}$

14) $D^6C^{-4}D^2D^4C^0C^{-2} = C^{-6}D^{12}$

15) $8 \times 10^4 + 6 \times 10^3 + 9 \times 10^2 + 4 \times 10^{-1}$

16) $Y = 2/3\ X + 2$
see graph

17) $m = 2/3$
$(-3) = 2/3(-3) + b$
$b = -1$
$Y = 2/3\ X - 1$ or $2X - 3Y = 3$
see graph



18)

weeks	dollars
2	$9
3	$27
4	$81
5	$243

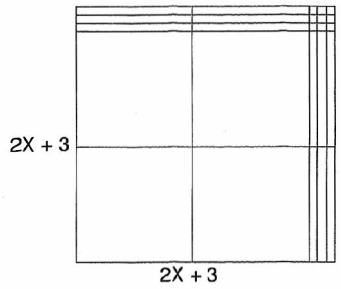
19)

weeks	dollars
1	3^1
2	3^2
3	3^3
4	3^4
5	3^5

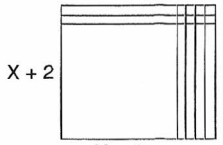
20) 20 weeks = 3^{20}
= $3,486,800,000 (May be shown on your calculator as 3.4868×10^9)

22E

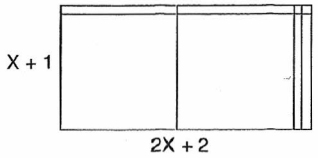
1) $(2X + 3)(2X + 3)$



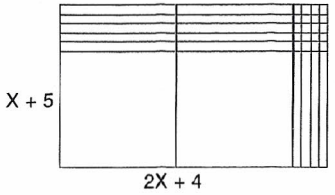
2) $2(X^2 + 6X + 8) = 2(X + 4)(X + 2)$



3) $2X^2 + 4X + 2$



4) $2X^2 + 14X + 20$



5) $(4X + 3)(X + 2)$

6)
$$\begin{array}{r} 4X + 3 \\ \times\ X + 2 \\ \hline 8X + 6 \\ 4X^2 + 3X \\ \hline 4X^2 + 11X + 6 \end{array}$$

7) $(2X + 1)(X + 5)$

8)
$$\begin{array}{r} 2X + 1 \\ \times\ X + 5 \\ \hline 10X + 5 \\ 2X^2 + X \\ \hline 2X^2 + 11X + 5 \end{array}$$

9) $(X + 3)(X + 1)$

10)
$$\begin{array}{r} X + 3 \\ \times\ X + 1 \\ \hline X + 3 \\ X^2 + 3X \\ \hline X^2 + 4X + 3 \end{array}$$

11) $B^{2+6-5}C^{2-5} = B^3C^{-3}$

12) Y^{5+A}

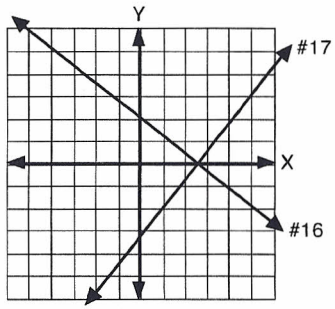
13) $D^8C^{-3}A^{-2}A^0D^7C^{-2} = A^{-2}C^{-5}D^{15}$

14) $A^5D^{-6}A^{-7}C^3D^8 = A^{-2}C^3D^2$

15) $3 \times 100{,}000 + 5 \times 1 + 2 \times 1/100 + 8 \times 1/1000 = 300{,}005.028$

16) $Y = -4/5\ X + 2$
see graph

17) $m = 5/4$
$(-2) = 5/4(1) + b$
$b = -13/4$
$Y = 5/4\ X - 13/4$ or $5X - 4Y = 13$
see graph



18)

day	grams
1	5
2	25
3	125
4	625

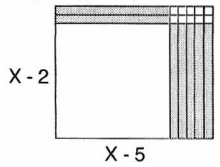
19)

day	grams
1	5^1
2	5^2
3	5^3
4	5^4

20) 8 days = 5^8
Y days = 5^Y

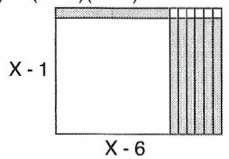
23A

1) $(X - 5)(X - 2)$



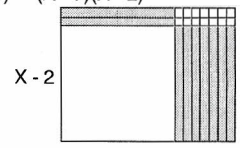
$$\begin{array}{r} X - 5 \\ \times\ X - 2 \\ \hline -2X + 10 \\ X^2 - 5X \\ \hline X^2 - 7X + 10 \end{array}$$

2) $(X - 6)(X - 1)$



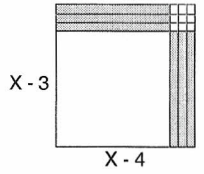
$$\begin{array}{r} X - 6 \\ \times\ X - 1 \\ \hline -X + 6 \\ X^2 - 6X \\ \hline X^2 - 7X + 6 \end{array}$$

3) $(X - 7)(X - 2)$



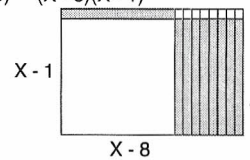
$$\begin{array}{r} X - 7 \\ \times\ X - 2 \\ \hline -2X + 14 \\ X^2 - 7X \\ \hline X^2 - 9X + 14 \end{array}$$

4) $(X - 4)(X - 3)$



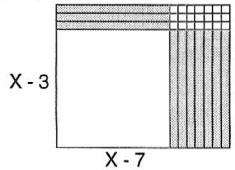
$$\begin{array}{r} X - 4 \\ \times\ X - 3 \\ \hline -3X + 12 \\ X^2 - 4X \\ \hline X^2 - 7X + 12 \end{array}$$

5) $(X - 8)(X - 1)$



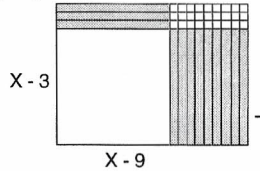
$$\begin{array}{r} X - 8 \\ \times\ X - 1 \\ \hline -X + 8 \\ X^2 - 8X \\ \hline X^2 - 9X + 8 \end{array}$$

6) $(X - 7)(X - 3)$



$$\begin{array}{r} X - 7 \\ \times\ X - 3 \\ \hline -3X + 21 \\ X^2 - 7X \\ \hline X^2 - 10X + 21 \end{array}$$

7) $(X - 9)(X - 3)$



$$\begin{array}{r} X - 9 \\ \times\ X - 3 \\ \hline -5X + 27 \\ X^2 - 9X \\ \hline X^2 - 12X + 27 \end{array}$$

8) $(X - 5)(X - 6)$

$$\begin{array}{r} X - 5 \\ \times\ X - 6 \\ \hline -6X + 30 \\ X^2 - 5X \\ \hline X^2 - 11X + 30 \end{array}$$

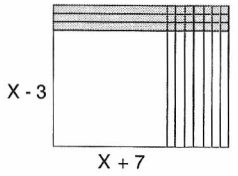
9) $(X - 9)(X - 10)$

$$\begin{array}{r} X - 9 \\ \times\ X - 10 \\ \hline -10X + 90 \\ X^2 - 9X \\ \hline X^2 - 19X + 90 \end{array}$$

10) $(X - 11)(X - 3)$

$$\begin{array}{r} X - 11 \\ \times\ X - 3 \\ \hline -3X + 33 \\ X^2 - 11X \\ \hline X^2 - 14X + 33 \end{array}$$

11) $(X + 7)(X - 3)$



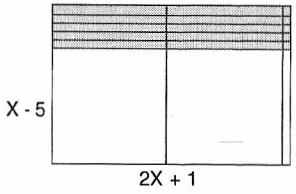
$$\begin{array}{r} X + 7 \\ \times\ X - 3 \\ \hline -3X - 21 \\ X^2 + 7X \\ \hline X^2 + 4X - 21 \end{array}$$

12) $(X + 7)(X - 5)$ Continue to check by multiplying.

13) $(X + 6)(X - 3)$

14) $(X - 9)(X + 4)$

15) $(2X + 1)(X - 5)$



16) $(2X - 3)(X + 4)$