Algebra 2 Competency Exam

To receive the full benefit of this test, watch the student to ensure he has mastered the concepts presented in Algebra 2.
If he demonstrates proficiency, he is ready to move on to PreCalculus.
If he struggles with the material on this exam, he should begin in Algebra 2.

Simplify or put in standard form.

1) $(X^7 \div X^3) + (X^2 \cdot X^2) =$

2) $\frac{A^5B^{-3}}{B^3A^2} =$

3) $\left(\frac{8}{27}\right)^{-\frac{1}{3}} =$

4) $2\sqrt{5} + 7\sqrt{5} =$

5) $\frac{X}{3+i} =$

6) $\frac{3}{1+\sqrt{3}} =$

Add or Subtract.

7) $\frac{5}{6X} + \frac{4}{3Y} =$

8) $5Q^{-1}R\,Q^2 + 3QR - R =$

Solve using scientific notation.

9) $(.0009)(.027) =$

10) $\frac{3{,}700{,}000}{.002} =$

Solve for the unknown.

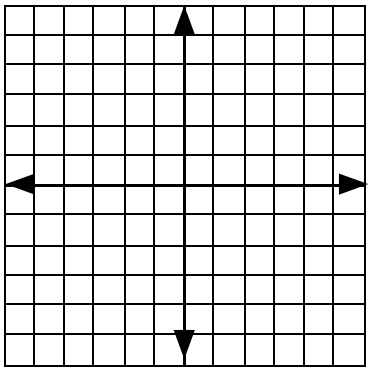
11) $2X^2 - 9X = 35$

12) $X^2 + 4X - 4 = -3X$

Find the solutions for each pair of equations. Sketch a graph of each equation and show the solutions.

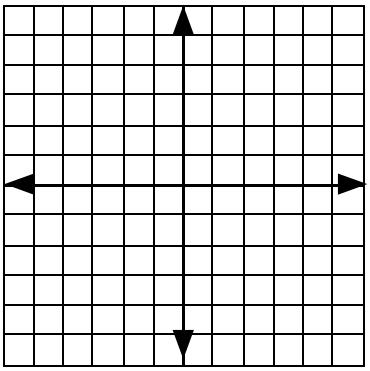
13) $Y = X^2 + 2$

$Y = X + 2$



14) $X^2 + Y^2 = 1$

$X^2 - Y^2 = 1$



Answer the questions.

15) A new computer is being discounted 15%. If the original price was $1,565, what is the new price?

16) The atomic weight of sodium (Na) is 23 and that of chlorine (Cl) is 35. What is the percentage of sodium in NaCl?

17) The ratio of cats to dogs is 5 to 18. If there are 10 cats, how many dogs are there?

18) There are .62 miles in 1 kilometre. How many miles are there in 10 kilometres?

19) Michael and Alexandra left their home at 8:00 AM to drive to New York. Michael drove at 55 kilometres an hour and arrived at 5:00 PM. Alexandra drove at 45 kilometres an hour and arrived at the same place as Michael. What time did Alexandra arrive?

20) I am visiting the USA where a dime is worth 10 cents, and a quarter is worth 25 cents. I have 15 coins in my pocket. They are all either dimes or quarters. The value of the coins is $3.15. How many of each coin do I have?

21) Find three consecutive even integers such that three times the first, plus two times the second, minus the third equals sixteen.

22) A landscaper wants 100 kilograms of grass seed mixture that is 45% of type A seed and 55% of type B. He has a mixture that is 10% type A and one that is 60% type A. How much of each should he use to make the desired mixture?

23) In six years Rose will be two times as old as Anne. Four years ago, Anne was one third the age of Rose. How old are they now?

24) A boat can go 26 kilometres downstream in the same time it takes to go 6 kilometres upstream. The rate of the water is 5 kilometres per hour. What is the rate of the boat?

Solutions

1) $(X^7 \div X^3) + (X^2 \cdot X^2) = X^{7-3} + X^{2+2} = X^4 + X^4 = 2X^4$

2) $\frac{A^5B^{-3}}{B^3A^2} = A^{5-2}B^{-3-3} = A^3B^{-6}\ \text{OR}\ \frac{A^3}{B^6}$

3) $\left(\frac{-8}{27}\right)^{-\frac{1}{3}} = \left(\frac{27}{8}\right)^{\frac{1}{3}} = \frac{3}{2} = 1\frac{1}{2}$

4) $2\sqrt{5} + 7\sqrt{5} = 9\sqrt{5}$

5) $\left(\frac{X}{3+i}\right)\left(\frac{3-i}{3-i}\right) = \frac{X(3-i)}{3^2 - i^2} = \frac{X(3-i)}{9-(-1)} = \frac{X(3-i)}{10}$

6) $\left(\frac{-3}{1+\sqrt{3}}\right)\left(\frac{1-\sqrt{3}}{1-\sqrt{3}}\right) = \frac{3(1-\sqrt{3})}{1^2 - \sqrt{3}^2} = \frac{3(1-\sqrt{3})}{1-3} = \frac{3-3\sqrt{3}}{-2}$

7) $\frac{5}{6X} + \frac{4}{3Y} = \left(\frac{5}{6X}\right)\left(\frac{Y}{Y}\right) + \left(\frac{4}{3Y}\right)\left(\frac{2X}{2X}\right) =$

$\frac{5Y}{6XY} + \frac{4(2X)}{6XY} = \frac{5Y+8X}{6XY}$

8) $5Q^{-1}RQ^2 + 3QR - R = 5QR + 3QR - R = 8QR - R$

9) $(9 \times 10^{-4})(2.7 \times 10^{-2}) = (9 \times 2.7)(10^{-4}10^{-2}) =$

$24.3 \times 10^{-6}\ \text{or}\ 2.43 \times 10^{-5}$

10) $\frac{3.7 \times 10^6}{2 \times 10^{-3}} = \frac{3.7}{2} \times 10^9 = 1.85 \times 10^9 = 1,850,000,000$

11) $2X^2 - 9X = 35$

$2X^2 - 9X - 35 = 0$

$X = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(-35)}}{2(2)}$

$X = \frac{9 \pm \sqrt{81-(-280)}}{4} = \frac{9 \pm \sqrt{361}}{4} = \frac{9 \pm 19}{4}$

$X = \frac{9+19}{4} = \frac{28}{4} = 7,\ \text{or}\ X = \frac{9-19}{4} = \frac{-10}{4} = -2\frac{1}{2}$

12) $X^2 + 4X - 4 = -3X$

$X^2 + 7X - 4 = 0$

$X = \frac{-(7) \pm \sqrt{7^2 - 4(1)(-4)}}{2(1)}$

$X = \frac{-7 \pm \sqrt{49-(-16)}}{2}$

$X = \frac{-7 \pm \sqrt{65}}{2}$

$X = \frac{-7+\sqrt{65}}{2},\ \text{or}\ X = \frac{-7-\sqrt{65}}{2}$

13) $Y = X^2 + 2$

$Y = X + 2$

substitute $X + 2$ for Y:

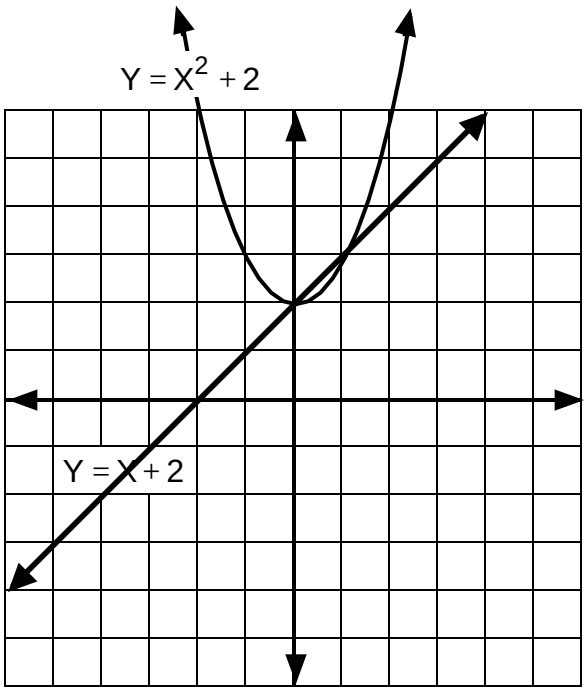
$(X+2) = X^2 + 2$

$X = X^2$

$X^2 - X = 0$

$(X)(X-1) = 0$

$X = 0$	$X = 1$
$Y = (0) + 2$	$Y = (1) + 2$
$Y = 2$	$Y = 3$
$(0,2)$	$(1,3)$



Solutions

14) $X^2 + Y^2 = 1$

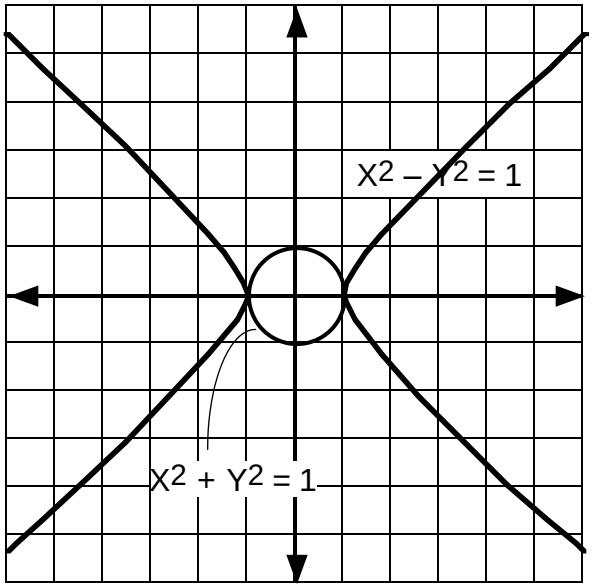
$\underline{X^2 - Y^2 = 1}$

$2X^2 = 2$

$X^2 = 1$

$X = \pm 1$

$(1)^2 + Y^2 = 1$	$(-1)^2 + Y^2 = 1$
$1 + Y^2 = 1$	$1 + Y^2 = 1$
$Y^2 = 0$	$Y^2 = 0$
$Y = 0$	$Y = 0$
$(1, 0)$	$(-1, 0)$



15) .15 x \$1,565 = \$234.75 off
\$1,565 - \$234.75 = \$1330.25

16) 23 = WP x (35 + 23)
23 = WP x 58
23 ÷ 58 = WP
WP = 40% (rounded)

17) $\frac{C}{D} = \frac{5}{18}$

$\frac{10}{D} = \frac{5}{18}$

$5D = (10)(18)$

$D = (2)(18)$

$D = 36$

18) .62 · 10 = 6.2 mi.

19) $D_M = R_M T_M$
$D_M = (55)(9)$
$D_M = 495\text{ mi.}$
$D_A = R_A T_A$
$D_M = D_A$
$715 = 45(T_A)$
$T_A = 11\text{ hours}$
arrived at 7:00 PM

20) D + Q = 15
.10D + .25Q = 3.15
10D + 25Q = 315
-(10D + 10Q = 150) (1st equation x 10)
15Q = 165
Q = 11
D + (11) = 15
D = 4

21) $3(X) + 2(X + 2) - (X + 4) = 16$
$3X + 2X + 4 - X - 4 = 16$
$4X = 16$
$X = 4$
3 numbers are 4, 6, and 8

22) $M_T + M_S = 100$
$.10M_T + .60M_S = .55(100)$
$10M_T + 60M_S = 5{,}500$ (2nd equation x 100)
$-(\underline{10M_T + 10M_S = 1{,}000})$ (1st equation x 10)
$50M_S = 4{,}500$
$M_S = 90$ kg
$M_T + (90) = 100$
$M_T = 10$ kg

23) R + 6 = 2(A + 6) (equation 1)
R + 6 = 2A + 12
R = 2A + 6
(A - 4) · 3 = R - 4 (equation 2)
(A - 4) · 3 = (2A + 6) - 4 (substitute for R)
3A - 12 = 2A + 2
A = 2 + 12 = 14 years old
R = 2(14) + 6
R = 28 + 6 = 34 years old

24) $D_D = R_D T_D$
$26 = (B + W)(T)$ $\quad (T_U = T_D)$
$26 = (B + 5)T$
$T = \frac{26}{B + 5}$
$D_U = R_U T_U$
$6 = (B - W)(T)$
$6 = (B - 5)T$

$T = \frac{6}{B - 5}$
$\frac{26}{B + 5} = \frac{6}{B - 5}$
$6(B + 5) = 26(B - 5)$
$6B + 30 = 26B - 130$
$160 = 20B$
$8 = B$