MULTIPLE CHOICE

1. Factor completely: $12x^2 - 92x$.

   a. $4x(3x - 23)$
   b. $x(12x - 92)$
   c. $4x(3x - 23x)$
   d. $4(3x^2 - 23x)$

   ANS: A

   x is a common factor of both terms. So we have: $12x^2 - 92x = x(12x - 92)$.

   gcf(12, 92) = 4.

   So, $12x^2 - 92x = x(12x - 92) = 4x(3x - 23)$.

	Feedback
A	Correct!
B	You forgot to find the common factor of the coefficients.
C	You forgot to take out the x in the second term - oops, we all do that!
D	You forgot to factor out x.

PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are similar; Q4 has a trickier answer.

2. Factor completely: $10x^2 + 100x$.

a. $5(2x^2 + 20x)$
b. $10x(x + 10)$
c. $5x(2x + 20)$
d. $x(10x + 100)$

ANS: B

x is a common factor of both terms. So we have: $10x^2 + 100x = x(10x + 100)$.

gcf(10, 100) = 10.

So, $10x^2 + 100x = x(10x + 100) = 10x(x + 10)$.

	Feedback
A	You forgot to factor out x.
B	Correct!
C	You did not factor completely the coefficients!
D	You did not find the largest common factor of the coefficients.

PTS: 2 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are similar; Q4 has a trickier answer.

3. Factor: $x^2 + 18x + 77$

a. $(x + 18)(x + 77)$
b. $(x + 7)(x + 11)$
c. $(x - 7)(x + 11)$
d. $(x - 7)(x - 11)$

ANS: B

The coefficient of x^2 is 1, so we need to find numbers: b and d such that:
$x^2 + 18x + 77 = (x \quad b)(x \quad d)$.

The constant coefficient is 77. This means that: $b \cdot d = 77$.

The constant coefficient is positive, that is: $77 > 0$.

So, the sum of b and d is the absolute value of the coefficient of x, that is: $b + d = 18$.

What are b and d? $b = 7$ and $d = 11$.

Now we need to find the **signs** in front of b and d.

Again, the constant coefficient is: $77 > 0$.

So the signs in front of b and d are the same.

The coefficient of x is positive, that is: $18 > 0$.

This means both signs are *positive*.

So the sign in front of *7* is positive and the sign in front of 11 is positive.

We have: $x^2 + 18x + 77 = (x + 7)(x + 11)$.

	Feedback
A	You did not factor at all! You need to review factoring rules.
B	Correct!
C	One of the signs in front of your factors is wrong.
D	Both of the signs in front of your factors are wrong.

PTS: 2 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are the same; Q3 has longer rationale.

4. Factor: $x^2 + 4x - 77$.

a. $(x + 4)(x - 77)$
b. $(x - 7)(x + 11)$
c. $(x + 7)(x - 11)$
d. $(x - 7)(x - 11)$

ANS: B

We need to find numbers: b and d such that: $x^2 + 4x - 77 = (x \quad b)(x \quad d)$

where $b \cdot d = 77$ and $b - d = 4$ (the **difference** since the constant coefficient $-77 < 0$).

We find: $b = 7$ and $d = 11$.

Since the constant coefficient is $-77 < 0$, the signs in front of b and d are **different**.

Since the x coefficient is $4 > 0$, the sign in front of the larger number 11 is *positive*.

We have: $x^2 + 4x - 77 = (x - 7)(x + 11)$.

	Feedback
A	You did not factor at all! You need to review factoring rules.
B	Correct!
C	Both of the signs in front of your factors are wrong.
D	One of the signs in front of your factors is wrong.

PTS: 2 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are the same; Q3 has longer rationale.

5. Factor: $x^3 + 13x^2 - 30x$.

a. $x(x-2)(x+15)$
b. $(x-2)(x^2-15)$
c. $(x^2+13)(x-30)$
d. $x(x+2)(x-15)$

ANS: A

We first factor out x: $x^3 + 13x^2 - 30x = x(x^2 + 13x - 30)$.

Now we factor: $x^2 + 13x - 30$.

We need to find numbers: b and d such that: $x^2 + 13x - 30 = (x \quad b)(x \quad d)$

where $b \cdot d = 30$ and $b - d = 13$ (the **difference** since the constant coefficient $-30 < 0$).

We find: $b = 2$ and $d = 15$.

Since the constant coefficient is $-30 < 0$, the signs in front of b and d are **different**.

Since the x coefficient is $13 > 0$, the sign in front of the larger number 15 is *positive*.

We have: $x^2 + 13x - 30 = (x-2)(x+15)$ so: $x^3 + 13x^2 - 30x = x(x-2)(x+15)$

	Feedback
A	Correct!
B	You need to factor the x out first and then factor the remaining quadratic.
C	You did not factor at all! You need to review factoring rules.
D	One or both of the signs in front of your factors is wrong.

PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: polynomials | quadratics | factoring

6. Factor: $25m^2 - 121x^2$

a. Does not factor.
c. $(5m - 11x)(5m + 11x)$
b. $(25 - x)(m + 121)$
d. $(5m - 11x)^2$

ANS: C

This is the difference of two squares, namely:

$25m^2 - 121x^2 = (5m)^2 - (11x)^2 = (5m - 11x)(5m + 11x)$

	Feedback
A	It does factor. Look up your formulas!
B	Wrong, but creative. Look up your formulas!
C	Correct!
D	Wrong formula. This generates a middle term.

PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring

7. Factor: $9g^2 + 64z^2$

a. $(3g - 8z)(3g + 8z)$
c. $(9 + z)(g + 64)$
b. $(3g - 8z)^2$
d. Does not factor.

ANS: D
This is the sum of two squares. There are no common factors. This quadratic will not factor!

	Feedback
A	Wrong formula. This gives a “minus” between the terms.
B	Wrong formula. This generates a middle term.
C	Wrong, but creative. Look up your formulas!
D	Correct!

PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring

8. Factor: $x^2 - 6x + 9$.

a. $(x - 3)(x + 2)$
b. $(x + 3)^2$
c. $(x + 3)(x - 3)$
d. $(x - 3)^2$

ANS: D

We notice that the constant coefficient is positive and a perfect square, that is: $9 = 3^2$.

We check to see if the middle term is $2 \cdot 3 = 6$. It is.

So, we have: $x^2 - 6x + 9 = x^2 - 2 \cdot 3 + 3^2$.

From the formula, we know: $x^2 - 6x + 9 = x^2 - 2 \cdot 3 + 3^2 = (x - 3)^2$,

(where the sign matches the sign in front of the x coefficient).

	Feedback
A	You did not factor at all! You need to review factoring rules.
B	Your sign is wrong.
C	This is the wrong formula.
D	Correct!

PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are the same; Q3 has longer rationale.

9. Factor: $2(4-y)-j(4-y)$.

a. Does not factor.
b. $(8-y)(1-j)$
c. $2j(4-y)^2$
d. $(4-y)(2-j)$

ANS: D
The common factor in both terms is: .

We put this factor first and see what is left:

From the first term: 2 is left. Then the sign: –. Finally the variable: j.

So: $(4-y)2-(4-y)j=(4-y)(2-j)$

	Feedback
A	It does factor. Do you see something the same in both terms?
B	No. Do not multiply anything. Simply factor out the common term.
C	No. You forgot the sign between the terms.
D	Correct!

PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: The conditions move the relative position of the factors.

10. Factor: $-2x^2 - 32x + 34$.

a. $-2(x - 1)(x + 17)$
b. $-2(x - 1)(x - 17)$
c. $-2(x + 16)(x + 17)$
d. $(x - 1)(x + 17)$

ANS: A

The leading coefficient can be factored out from the other coefficients:

$-2x^2 - 32x + 34 = -2(x^2 + 16x - 17)$.

Now we factor: $x^2 + 16x - 17$.

We need to find numbers: b and d such that: $x^2 + 16x - 17 = (x \quad b)(x \quad d)$

where $b \cdot d = 17$ and $b - d = 16$ (the **difference** since the constant coefficient $-17 < 0$).

We find: $b = 1$ and $d = 17$.

Since the constant coefficient is $-17 < 0$, the signs in front of b and d are **different**.

Since the x coefficient is $16 > 0$, the sign in front of the larger number 17 is *positive*.

We have: $x^2 + 16x - 17 = (x - 1)(x + 17)$.

The answer is: $-2x^2 - 32x + 34 = -2(x - 1)(x + 17)$

	Feedback
A	Correct!
B	Check your signs.
C	You are guessing. Find the roots and then use them to factor.
D	You forgot to multiply by the leading coefficient.

PTS: 3 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are the same; Q3 has longer rationale.

11. Factor using roots: $x^2 + 12x + 35$.

a. $(x + 5)(x + 7)$
b. $(x - 5)(x + 7)$
c. $(x - 5)(x - 7)$
d. $(x + 12)(x + 35)$

ANS: A

For $x^2 + 12x + 35$, we have: $a = 1$, $b = 12$ and $c = 35$.

Using the quadratic formula:

$$x_1, x_2 = \frac{-12 \pm \sqrt{(12)^2 - 4 \cdot 1 \cdot 35}}{2 \cdot 1}$$

$$= \frac{-12 \pm \sqrt{4}}{2}$$

Using a calculator (if necessary), we have:

$$x_1, x_2 = \frac{-12 \pm 2}{2}.$$

$$x_1 = \frac{-12 + 2}{2} = -5 \quad \text{and } x_2 = \frac{-12 - 2}{2} = -7$$

We have: $x^2 + 12x + 35 = (x + 5)(x + 7)$

(Remember to subtract your roots.)

	Feedback
A	Correct!
B	One of the signs in front of your factors is wrong.
C	You need to subtract the roots. Both of your signs are wrong.
D	Wow is this wrong! Use the quadratic formula to find the roots.

PTS: 2 DIF: Grade 8 REF: 1ALG.11.0
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KEY: quadratics | factoring
MSC: Questions 3 and 4 are the same; Q3 has longer rationale.

12. Factor: $5x^2 + 54x + 40$.

a. $(5x + 4)(x + 10)$

b. $(5x - 4)(x - 10)$

c. $(x + \frac{4}{5})(x + 10)$

d. $5(x + 54)(x + 40)$

ANS: A

The leading coefficient cannot be factored out from the other coefficients.

So, it is probably easiest to factor by finding the roots.

For $5x^2 + 54x + 40$, we have: $a = 5$, $b = 54$ and $c = 40$.

Using the quadratic formula:

$$x_1, x_2 = \frac{-54 \pm \sqrt{(54)^2 - 4 \cdot 5 \cdot 40}}{2 \cdot 5}$$

$$= \frac{-54 \pm \sqrt{2116}}{10}$$

Using a calculator (if necessary), we have:

$$x_1, x_2 = \frac{-54 \pm 46}{10}.$$

$$x_1 = \frac{-54 + 46}{10} = -\frac{4}{5} \quad \text{and } x_2 = \frac{-54 - 46}{10} = -10$$

We have: $5x^2 + 54x + 40 = 5(x + \frac{4}{5})(x + 10) = (5x + 5 \cdot \frac{4}{5})(x + 10) = (5x + 4)(x + 10)$.

(Don't forget to multiply by the leading coefficient!)

	Feedback
A	Correct!
B	You forgot to subtract the roots so your signs are wrong.
C	You forgot to multiply by the leading coefficient.
D	You are guessing. Find the roots and then use them to factor.

PTS: 4 DIF: Grade 8 REF: 1ALG.11.0
OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
KEY: quadratics | factoring
MSC: Questions 3 and 4 are the same; Q3 has longer rationale.

NUMERIC RESPONSE

1. What is the **smallest** of the multiples when calculating $(129^2 - 29^2)$ using only one multiplication?

   ANS: 100

   PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
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   KEY: quadratics | factoring

2. What is the **largest** of the multiples when calculating $(186^2 - 86^2)$ using only one multiplication?

   ANS: 272

   PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
   OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
   KEY: quadratics | factoring

3. What is the **smallest** of the multiples when calculating $(169^2 - 109^2)$ using only one multiplication?

   ANS: 60

   PTS: 2 DIF: Grade 8 REF: 1ALG.11.0
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   KEY: quadratics | factoring

4. What is the **smallest** of the multiples when calculating $(199^2 - 149^2)$ using only one multiplication?

   ANS: 50

   PTS: 2 DIF: Grade 8 REF: 1ALG.11.0
   OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
   KEY: quadratics | factoring

5. Without using a calculator, find the **value of *x*** if $(181^2 - 4) = 183 \cdot x$?

   ANS: 179

   PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
   OBJ: Students apply basic factoring techniques to second-and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. TOP: Algebra 1
   KEY: quadratics | factoring

6. Without using a calculator, find the **value of *x*** if $(178^2 - 4) = x \cdot 176$?

   ANS: 180

   PTS: 1 DIF: Grade 8 REF: 1ALG.11.0
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   KEY: quadratics | factoring