

**SCHEDA CATALOGO**

<b>Scuola</b>	Liceo Scientifico N. Copernico
<b>Autori</b>	Silvia Valente
<b>Titolo del modulo</b>	Dividing polynomials
<b>classe</b>	prima
<b>livello linguistico</b>	A2 Pre-intermediate
<b>obiettivi disciplinari</b>	Saper dividere due polinomi. Saper utilizzare il teorema del resto.
<b>contenuti disciplinari</b>	Divisione tra un polinomio e un monomio. Divisione tra polinomi. Regola di Ruffini. Teorema del resto e teorema di Ruffini.
<b>punto del programma</b> (eventuali prerequisiti)	Conoscere e saper operare con i polinomi.
<b>numero di ore</b>	10
<b>materiale</b> (libri, software, DVD, videocassette, fotocopie...)	Fotocopie (anche download dal blog dell'insegnante sul sito della scuola), quaderno, libro di testo
<b>supporti</b> (laboratorio, lavagna luminosa, video....)	lavagna
<b>compresenza (SI/NO)</b>	NO

**LESSON PLAN****SCHEMA DELLE LEZIONI****DIVIDING POLYNOMIALS**

1^ lezione 60'

***Glossaries.***

Lettura e analisi dei *glossaries*:

Mathematics Glossary.doc ([Allegato 1](#)) e Dividing polynomials Glossary .doc ([Allegato 2](#))

Semplici applicazioni relativamente a cose note.

Materiale da distribuire: i due *glossaries* e Mathematics Word Search.doc ([Allegato 3](#))

Per casa: studiare i *glossaries* (sapere soprattutto da inglese a italiano) e ricercare le parole (All.3).

2^ lezione 1 ora e 30'

***Preliminary exercises. Dividing a polynomial by a monomial***

Lezione interattiva: utilizzo delle parole dei glossari in contesti matematici noti (esercizi True-false, Fill in, ... dalla scheda). Divisione di un polinomio per un monomio.

Materiale da distribuire:

Preliminary exercises.doc ([Allegato 4](#)) e Mathematics Crossword.doc ([Allegato 5](#))

Per casa: ripetere quanto visto e fare il cruciverba (All. 5).

3^ lezione 50'

***Polynomial long division***

Dalla divisione di numeri all'algorithmo della divisione per polinomi in una sola variabile. Legame tra dividendo, divisore, quoziente e resto e i rispettivi gradi.

Materiale da distribuire:

Letter Tiles.doc ([Allegato 6](#)) e Dividing Polynomials Double Puzzle.doc ([Allegato 7](#))

Per casa: ex dal testo e dalle schede (ricerca dei messaggi) (All. 6 e 7).

4^ lezione 50'

***Exercises***

Esercizi dalla scheda (All. 9)

Materiale da distribuire: Dividing Polynomials Map.doc ([Allegato 8](#)) e Exercises.doc ([Allegato 9](#))

Per casa: ex dal testo, dalla scheda (All. 9) e ripasso della teoria.

5^ lezione 50'

***Ruffini's rule***

Regola di Ruffini (polinomi in una sola variabile)

Materiale da distribuire: Ruffini's Rule Double Puzzle.doc ([Allegato 10](#))

Per casa: ex dal testo e dalle schede (All. 9 e 10)

6^ lezione 50'

***Dividing polynomials with more than one variable***

Divisione di polinomi a coefficienti letterali, osservazioni su quoziente e resto.

Per casa: esercizi dal testo e dalla scheda (All. 9).

7^ lezione 50'

***The Remainder theorem and Ruffini's theorem***

I due teoremi con dimostrazione e applicazioni.

Per casa: esercizi dal testo e dalla scheda (All. 9); studiare la mappa (All. 8).

8^ lezione 60'

**Exercises**

Eventuale correzione degli esercizi per casa ed esercizi riassuntivi dalla scheda (All.11)

Materiale da distribuire: Module summary.doc (**Allegato 11**) e Hidden Message.doc (**Allegato 12**)

Per casa: esercizi dal testo e ricerca del messaggio nascosto (All. 12).

9^ lezione 60'

**Test**

Il test è formato da 10 domande *Multiple Choice* , 9 *Fill in the gaps* e alcuni esercizi applicativi.

10^ lezione 50'

**Test correction**

La valutazione linguistica era mirata alla comprensione del testo e all'utilizzo appropriato dei termini del lessico matematico (nell'esercizio *Fill in the gaps*).

NOTE

- Solo la prima lezione è bilingue (presentazione e commento dei glossari), nelle altre parlo esclusivamente in inglese e invito i ragazzi a fare altrettanto. Se qualcuno non riesce può porre la domanda in italiano.
- I giochi di diverso tipo (Allegati 3, 5, 6, 7, 10, 12) hanno lo scopo di rendere più stimolante, piacevole e semplice l'apprendimento e la memorizzazione di vocaboli e di frasi chiave.
- Tutte le lezioni sono interattive, con l'esclusione di qualche brevissima spiegazione frontale.
- Il file che ho nominato "IL MIO FILE text" è un semplice supporto al mio insegnamento. Si tratta di un collage di frasi, terminologia matematica e lessico specifico, tratto da libri di testo nord americani e inglesi e da siti (indicati in grassetto tra parentesi nel file), a cui attingo durante la preparazione delle lezioni. Il suo scopo è stato di aiutarmi ad acquisire un linguaggio matematico corretto.
- Per creare i vari giochi ho utilizzato il sito [www.puzzlemaker.com](http://www.puzzlemaker.com)

**MATHEMATICS GLOSSARY**

natural (whole) numbers	numeri naturali (insieme N)
integer numbers	numeri interi (insieme Z)
rational numbers	numeri razionali (insieme Q)
irrational numbers	numeri irrazionali (insieme I)
real numbers	numeri reali (insieme R)
prime number	numero primo
odd number	numero dispari
even number	numero pari
digit	cifra
opposite of $a$	opposto di $a$ ( $-a$ )
reciprocal of $a$	reciproco di $a$ $\left(\frac{1}{a}\right)$
positive	positivo
negative	negativo
double	doppio

= equals, is equal to

< less than

≤ less than or equal to

> greater than

≥ greater than or equal to

$a + b$	a plus b	operation:	<i>addition</i>	result: <i>sum</i>
$a - b$	a minus b	operation:	<i>subtraction</i>	result: <i>difference</i>
$a \cdot b$	a times b	operation:	<i>multiplication</i>	result: <i>product</i>
$a : b$	a divided by b	operation:	<i>division</i>	result: <i>quotient</i> or <i>ratio</i>

to add to	addizionare
to subtract from	sottrarre
to multiply by	moltiplicare per
to divide by	dividere per, essere divisibile per
to be divisible by	essere divisibile per, essere multiplo di
factor	divisore, fattore

power	potenza
base	base
exponent	esponente
to raise	elevare
to square a number	elevare al quadrato
to cube a number	elevare al cubo
$a$ squared	$a$ elevato al quadrato, $a^2$
$a$ cubed	$a$ elevato al cubo, $a^3$
$a$ to the $n$ th power, $a$ to the power of $n$	$a$ elevato alla $n$ , $a^n$
fraction	frazione
fraction bar	linea di frazione
numerator	numeratore
denominator	denominatore
$a/b$	$a$ over $b$
$2/3$	2 over 3, two thirds
$1/4$	one fourth
$1/2$	one half (a half)
to reduce into lowest terms	ridurre ai minimi termini
to cancel	semplificare (frazioni, termini opposti)
GCF greatest common factor (USA)	M.C.D.
LCM least common multiple	m.c.m.
LCD least common denominator	minimo comun denominatore
parentheses ( <i>pl.</i> ) ( <i>sing.</i> parenthesis)	parentesi tonde ( )
(square) brackets	parentesi quadre [ ]
braces	parentesi graffe { }

**DIVIDING POLYNOMIALS GLOSSARY**

monomial	monomio
binomial	binomio
trinomial	trinomio
polynomial	polinomio
expression	espressione
variable	variabile
constant	costante
like terms	termini simili
unlike terms	termini non simili
constant (term)	termine noto
coefficient	coefficiente
leading term	termine di grado massimo
missing term	termine mancante
degree	grado
linear	lineare, di primo grado
less	minore
descending / ascending order	ordine decrescente/crescente
sign	segno
line	linea
column	colonna
row	riga, fila
value	valore
distributive property (over/with respect to)	proprietà distributiva (rispetto)
right distributive property (over)	proprietà distributiva a destra (rispetto)
with respect to	rispetto a
division	divisione
exact division	divisione esatta (resto=0)
to divide by	dividere per, essere divisibile per
to be divisible by	essere divisibile per, essere multiplo di
a : b	a divided by b
to go into	stare nel (ex. 5 goes into 20, 4 times)
dividend	dividendo
divisor	divisore
quotient	quoziente
remainder	resto

procedures, process	procedimento, procedura, metodo
method	metodo
theorem	teorema
rule	regola
algorithm	algoritmo
to reduce, to simplify	semplificare (ridurre i termini simili)
to factor	fattorizzare, scomporre
to expand	sviluppare (i calcoli, un'espressione)
to substitute (into)	sostituire (ex. Substitute 5 into (for) x = sostituisci 5 alla x)
to replace (with)	sostituire (ex. Replace x with 5= sostituisci 5 alla x)
to evaluate	valutare, determinare il valore di
to guess	indovinare, congetturare
to state	affermare, enunciare
to check	verificare, controllare
to arrange	disporre, mettere in ordine
to increase	aumentare, crescere
to decrease	diminuire, decrescere
to draw	tracciare, disegnare
to bring /carry down	portare giù, abbassare
to leave room (space)	lasciare spazio
to unscramble	decifrare
to search	ricercare
to reveal	svelare, rivelare
clue	indizio, traccia
clue word	parola chiave
tile	tessera (di mosaico), mattonella, tegola, piastrella
cell	cella
message	messaggio
hidden	nascosto

## MATHEMATICS WORD SEARCH

M E T H O D E S C E N D I N G  
 O D D N Y F I L P M I S A C V  
 E R U D E C O R P E U L A V E  
 C Q U O T I E N T M G R U L E  
 L E D C H E C K R O S I V I D  
 A E V I T U B I R T S I D V L  
 C Y T E F N M I F B D N A A R  
 O L H C N F T O I F E D I R E  
 R P E R A H E N N D E M A I M  
 P I O O M R O R I O O O E A A  
 I T R T M M T V E N M X C B I  
 C L E C I R I B Y N A I Q L N  
 E U M A D D E L U C C L A E D  
 R M L F E G O T T S S E L L E  
 E M I R P P O P P O S I T E R

ADD  
 CHECK  
 DIFFERENCE  
 DIVIDEND  
 EXACT  
 METHOD  
 ODD  
 PRIME  
 RECIPROCAL  
 SIMPLIFY  
 TERM  
 VARIABLE

ALGORITHM  
 COEFFICIENT  
 DISTRIBUTIVE  
 DIVISOR  
 FACTOR  
 MONOMIAL  
 OPPOSITE  
 PROCEDURE  
 REMAINDER  
 SUBTRACT  
 THEOREM

BINOMIAL  
 DESCENDING  
 DIVIDE  
 EVEN  
 LESS  
 MULTIPLY  
 POLYNOMIAL  
 QUOTIENT  
 RULE  
 SUM  
 VALUE

## PRELIMINARY EXERCISES

1) Classify each of the following as *true or false*. If the sentence is *false* correct it.

- The degree of a polynomial is the sum of the degrees of its terms.
- The constant term of a polynomial is a 0 degree monomial.
- The polynomial  $9 - 7x^5 + 6x^7 + 2x^8$  is written in descending order.
- A polynomial  $P$  has degree  $m$  and a polynomial  $Q$  has degree  $n$ . Their product has degree  $m + n$ .
- Two opposite binomials have the same square.
- 1 is a zero of the polynomial  $2x^2 - x - 1$ .

2) *Fill in*

- Subtracting a real number  $x$  is the same as ... the opposite of  $x$ .
- The opposite of  $x-3$  is ...
- The ... property states that  $a \cdot (b+c) = a \cdot b + a \cdot c$
- Division is ... distributive over addition and ...
- The quotient of two negative numbers is ...
- In  $5x^2$ , 5 is called the ...
- In  $x^n$ ,  $x$  is called the ...
- $6x^{-2}$  is not a monomial because it has a negative ...
- $4x+3$  is a ...
- The degree of  $7a^3bc^5$  is ...
- The degree of  $4x^3 + 3x^2$  is ...
- A monomial is an algebraic ... that consists of only ... term. The number in front of the variable is called the numerical .... Variables must have ... number exponents.
- A polynomial ... of two or more terms.
- A binomial is a polynomial that consists of exactly ... terms; it is the ... of two ...
- The degree of a ... is the highest degree of all the terms.
- Polynomials are usually arranged in one of two ways: ascending order or ....
- When a polynomial in one variable is written so that the exponents on the variable increase from left to right we say that the polynomial is written in ... order; if the exponents on the variable decrease from ... to right we say that the ... is written in ....
- The first term in the polynomial, when it is written in descending ... , is also the term with the biggest exponent, and is called the ...

3)

1. Find the polynomial  $P$  such that  $P + (2y^3 - 14x^2y^3 + 2x^3 - xy^2) = 0$

...

2. Add a term to the polynomial  $2a^2b^3x - 4a^3b^2x^5 - 6ab^4$  such that it is a 12 degree polynomial.

...

3. Write each product as a trinomial in descending order.

$$(2x-3)(3x-8) = \dots$$

$$2a(a+1)(5-a) = \dots$$

4. Find the monomial completing the equality  $(\dots)(6x-2y+3) = 12x^2 - 4xy + 6x$

5. Do the division:  $163:7 = \dots$ , then answer the following questions:

What is the quotient? ... What is the remainder? ... What is the dividend? ...

What is the divisor? ... Is the division an exact division? ... Why? ...

How can you check the answer? ...

6. Simplify using the right distributive property of division with respect to addition and subtraction:

$$(32+12-4):4 =$$

7. Arrange the polynomial  $3x - x^4 + 9x^2 + 2 - 7x^3$  in descending order: ...

8. Arrange the polynomial  $2xy^3 - 4yx^3 - 5x^2y^2 + 3x^4$  in two variables

in descending order first with respect to  $x$  ...

then with respect to  $y$  ...

9. Rewrite the polynomial  $2x^3 - 9 - 7x^5 + 6x$  in descending order, leaving proper room when one of the terms is missing: ...

10. Rewrite the polynomial  $2x^3 - 9 - 7x^5 + 6x$  in descending order, inserting 0 as the coefficient of the variable when one of the terms is missing: ...

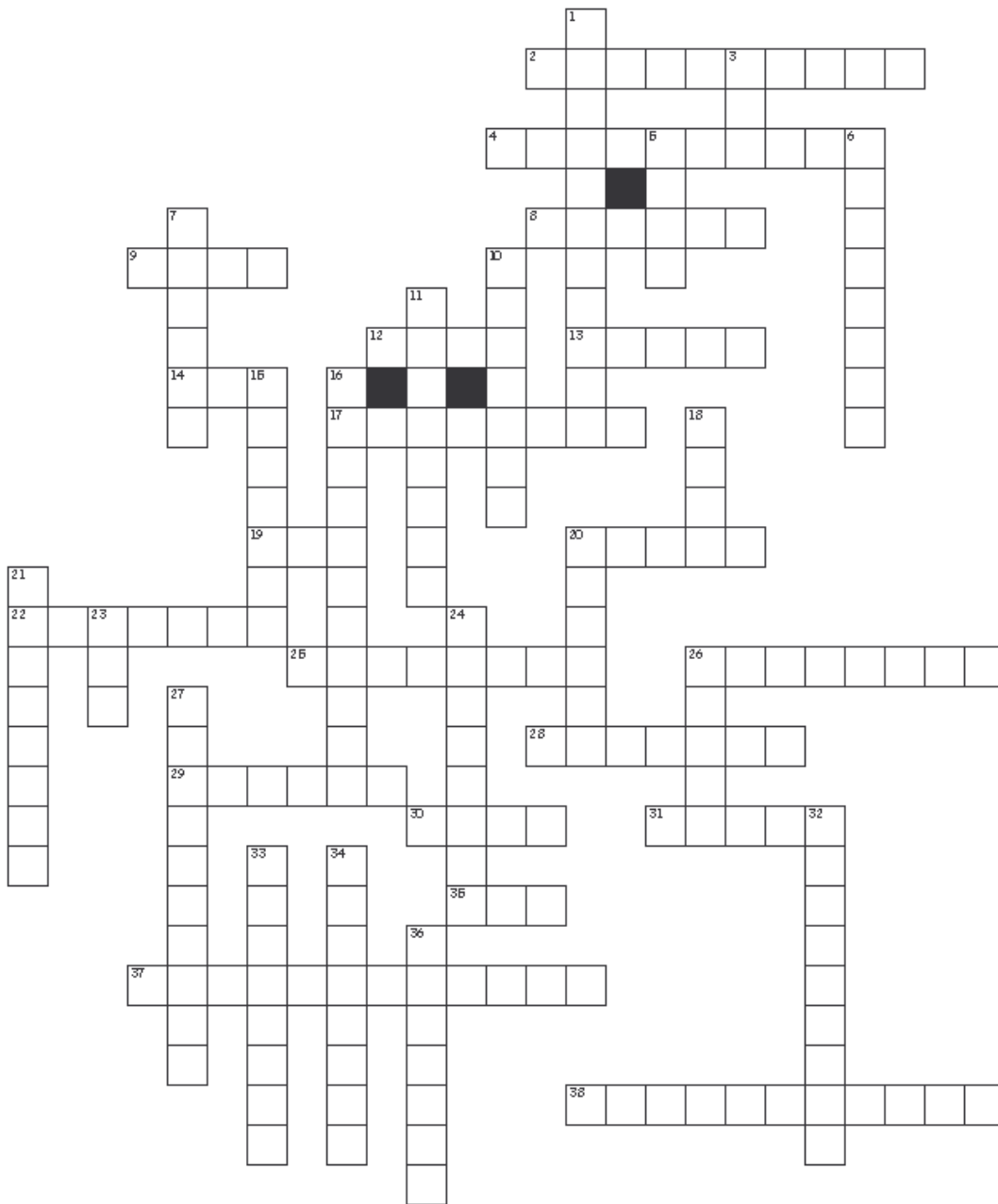
11. Draw the equals bar and add down:

$$\begin{array}{r} -4x^5 \quad +3x^4 \quad +0x^3 \quad -15x^2 \quad -5x \quad +9 \\ -2x^5 \quad \quad -7x^3 \quad \quad -x^2 \quad +x \quad +4 \end{array}$$

12. Given the polynomials  $a^5 - 7a^4 + 12a^3 + 2a^2 - 9a + 5$  and  $-a^5 - a^4 + 3a^2 + 4a - 2$

write them one under the other, lining up terms of equal degree. Then draw the equals bar and add down.

# MATHEMATICS CROSSWORD



**Across**

2. An algebraic expression consisting of the sum of two or more monomials
4. The result of a subtraction
8. So it is called an expression that is of the first degree
9. A number which is raised to a power
12. The value  $c$ , for a polynomial  $P(x)$ , such that  $P(c)=0$
13. So it is called a division with no remainder
14. A number of the form  $2n+1$
17. The verb used to find the value of a polynomial when the variable is replaced with a number
19. The result of an addition
20. A prime factor of 12
22. A positive or negative whole number
25. A number that can be expressed in the form  $a/b$
26. A number greater than zero
28. The name of the coefficient of the highest-degree term in a polynomial
29. The result when a number is multiplied by itself
30. Terms with the same letter parts
31. Evaluate  $2x-3y$  if  $x=2$  and  $y=-1$
35. The English for m.c.m.
37. The name of the property  $a(b+c)=ab+ac$
38. Two numbers whose product is one

**Down**

1. The number in front of a variable
3. The result of a number divided by itself
5. A number divisible by two
6. The number used to indicate the power of a number
7. A number that divides exactly into another number
10. The result of a multiplication
11. A number less than zero
15. The number you are dividing by
16. The bottom number in a fraction
18. The number you find when you square 3
20. The greatest common factor of 24 and 60
21. The number that you are dividing into
23. The only even prime number
24. A term that is the product of numbers and variables with whole exponents
26. A number that has exactly two different factors
27. To divide polynomials it is necessary to arrange them in this order
32. The top number in a fraction
33. The result of a division
34. A letter representing one or more numbers
36. His rule is also known as synthetic division

## LETTER TILES

B	Y	M	O	I	V	I	H	E	E	A	I	S	T	H	E	I	A	L			
N	O	M	E	B	D	I	C	H	L	I	V	I	S	I	A	L	M	O			
S	I	B	M	I	A	Y	N	O	N	O	M	I	B	L	I	F	N	O	M	S	D
F	T	P	O	L	T	E	R	L	E	Y	A	I	A	L	O	L	Y	A	P		
M	O																				


Unscramble the tiles to reveal a message.

## DIVIDING POLYNOMIALS DOUBLE PUZZLE

NIVIDSIO 

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35 23 40 41 19 39 30 5

HODTEM 

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7 34 28 29 37 42

LIOLYANOPM 

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1 49 10 4 13 45 50 51 25 11

SI 

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8 24

A 

--

  
9

NOALOLPYMIS 

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44 2 53 47 22 12 26 18 52 46 33

SUED 

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32 54 27 15

VIDDIE 

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38 16 17 20 31 43

GONL 

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3 21 48 14

TO 

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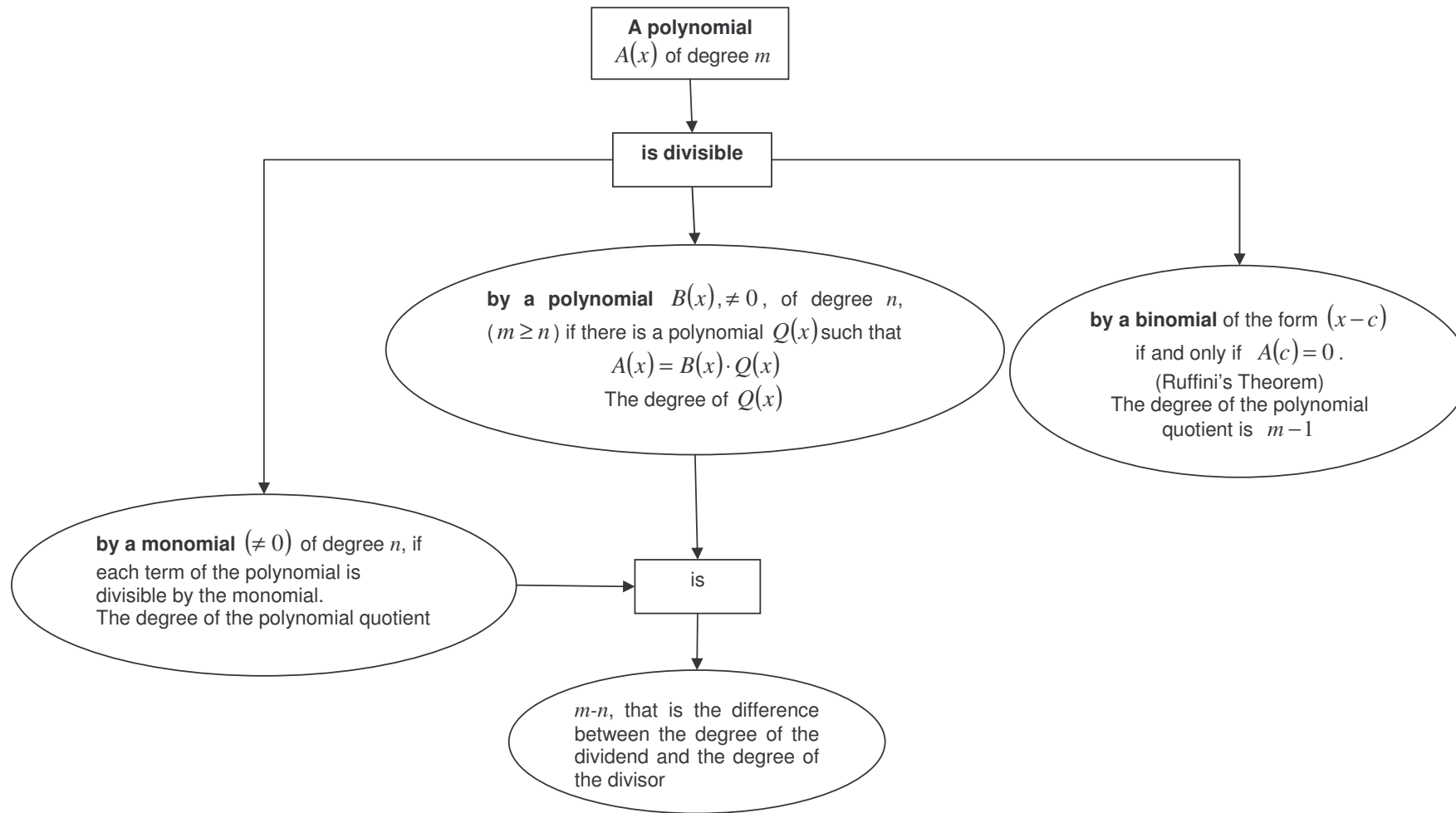
  
36 6

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54

Unscramble each of the clue words.  
 Copy the letters in the numbered cells to other cells with the same number.

**DIVIDING POLYNOMIALS MAP**

**Commento [SV1]:** Tradotto dal Persano Quaderno p. 120



### Exercises

- 1) Divide the polynomial  $4a^2 - 3a + 6a^3 - 2$  by  $1 + 2a$  and check the answer.
- 2) Find the value of  $k$  for which  $(3t+2)$  is a factor of  $15t^2-2t+k$ .
- 3) A rectangle of width  $(4x-9y)$  units has an area of  $(12x^2-11xy-36y^2)$  square units. Find the perimeter of the rectangle.
- 4) When  $6p^3-22p+c$  is divided by  $2p-4$ , the remainder is 5. Find  $c$ .
- 5) A rectangle has an area of  $6x^3+2x^2-9x-3$ ; it's length is  $2x^2-3$ . Find its perimeter.
- 6) The volume of a rectangular solid is  $n^3-n^2-9n+9$ . The length of the solid is  $n+3$  and the width is  $n-3$ . Find the height.
- 7) Use polynomial division to show that  $3x^5+4x^4+6x^3+8x^2-5x+4$  is divisible by  $3x^2-2x+1$ .
- 8) Find a polynomial  $P$  such that  $P : (x+1) = x-1$  with remainder 1.
- 9) Find the value of the polynomial  $P(x) = 2x^3+3x^2-7$ , at  $x = -2$ .
- 10) Evaluate  $P(x) = 6x^3 - 5x^2 + 4x - 17$  at  $x = 3$ .
- 11) Find the value of  $P(-5)$ , for  $P(x) = 3x^4 + 2x^3 + 4x$ .
- 12) Add a degree 0 term to the polynomial  $x^4 - x^2 - 2x$  such that it is divisible by  $x + 1$
- 13) Using the Remainder Theorem, find the value of  $k$  for which  $(x-3)$  is a factor of  $2x^3-x^2-17x+k$ .
- 14) Using the Remainder Theorem, find the remainder of  $P(y)=9y^4-6y^3+y-2$  divided by  $y-\frac{2}{3}$
- 15) *Classify each of the following as **true** or **false**. If the sentence is **false** correct it.*
  - a. A polynomial is divisible by a monomial if some terms of the polynomial are divisible by the monomial.
  - b. The degree of the polynomial quotient is the difference between the degree of the polynomial dividend and the degree of the polynomial divisor.
  - c. Given a polynomial  $P(x)$  and a binomial  $x-a$ ,  $P(a)$  is the remainder of the division of  $P(x)$  by  $x-a$ .
  - d. Ruffini's rule can be always used to divide polynomials.
  - e. Divisions in which there is zero remainder are called exact divisions.
  - f. The degree of the remainder is equal to the degree of the divisor.
  - g. A polynomial  $A(x)$  is divisible by a polynomial  $B(x)$  if there is a polynomial  $Q(x)$  such that  $A(x) = B(x) \cdot Q(x)$ .
  - h. The quotient of two opposite polynomials is  $-1$ .

Commento [RDM2]: tradott  
o io

Commento [RDM3]: tradott  
o io





# HIDDEN MESSAGE

I F A P O C L Y N O M I A L P  
 T H A T X X I S D I V I D E L  
 D H S U B S T I T U T I N G A  
 B D E Y X C T H E N T H E R I  
 E M I N A I N D D E R O F T M  
 H I S V D I V I E S I O N I O  
 R E M A I N D E R N S P C T N  
 V A L U E S I H T I I H A T Y  
 I S T H E V I D A N L A U E L  
 O B T A I N I O E T D B T Y O  
 S E H T U V B S N O T I T B P  
 U T I N I G C I N T O X I N O  
 T H E D P O L Y N O M I A L P  
 X A E I J O F H Y Q Z N B C H  
 N D L Y F Q L Z Z X J R C G N

DIVIDED  
 OBTAINED  
 SUBSTITUTING  
 THEN  
 X-C

DIVISION  
 POLYNOMIAL  
 THAT  
 THIS

INTO  
 REMAINDER  
 THE  
 VALUE

\_\_\_\_\_ ( \_ ) \_\_\_\_\_  
 \_\_\_\_\_ , \_\_\_\_\_  
 \_\_\_\_\_ ( \_ ) , \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ ( \_ )

