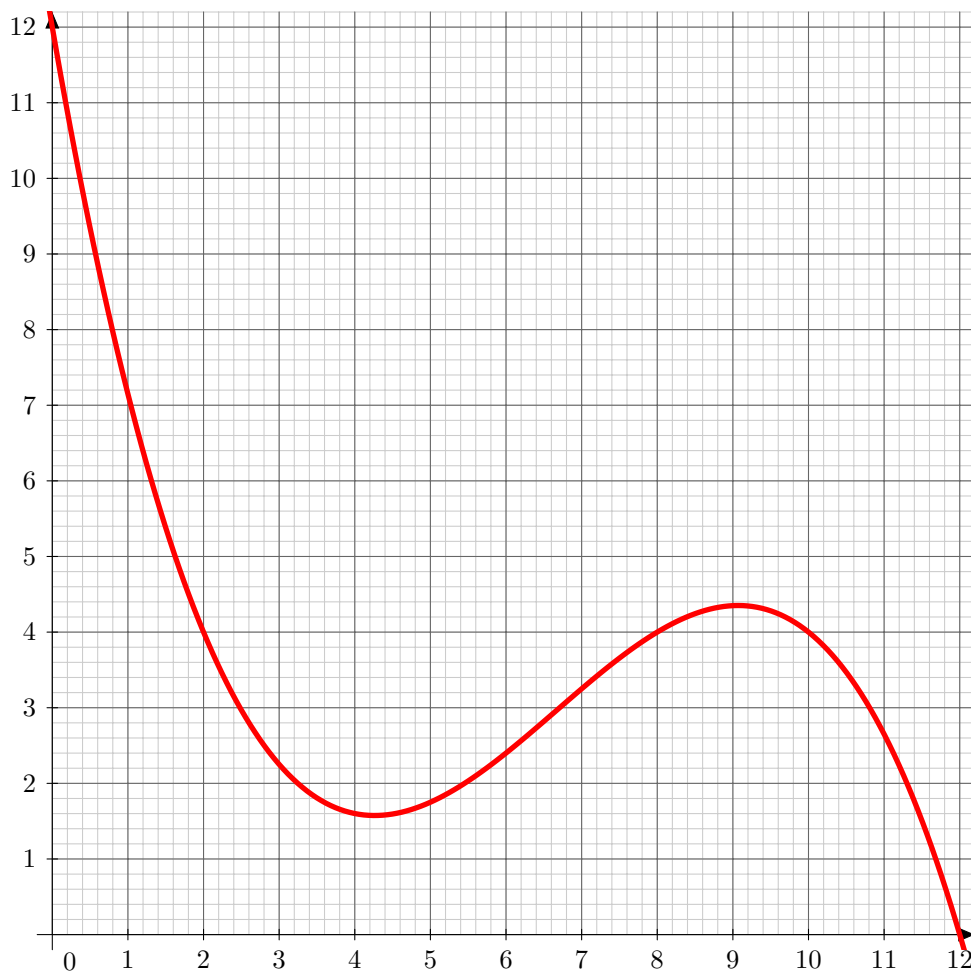




Homework 3

A professional skier goes down a ski slope and jumps on a springboard. Its trajectory is supposed to be flat (he goes down the slope directly, without turning) and modelled by a function f which gives the height of the skier in function of its horizontally travelled distance. Let \mathcal{C}_f be the representative curve of f given in the following graph (numerical data non-contractual).



Part I : graph reading

1. Estimate graphically the minimum of f on $[2; 6]$ and its maximum on $[6; 12]$.
2. What is the maximum of f on $[0; 12]$? its minimum?
3. Establish graphically the variation tabular of f on $[0; 12]$.
4. On which set the function f seems to be non-increasing?
5. Solve graphically the inequality $f(x) \geq 4$ (see Proposition II.3 of chapter 4).



Part II : algebraic expressions

Suppose that the algebraic expression of f is given for any $x \in [0; 12]$ by

$$f(x) = -\frac{1}{20} (x^2 - 10x + 16) (x - 10) + 4.$$

6. Calculate, giving details, the skier's height at $x = 0$, $x = 6$ et $x = 12$.
7. Develop the expression of f (and simplify the final result).
8. Using this new formula of f , find again the results of the question 6.

We want to know when the skier is at a height greater than or equal to 4.

9. Prove carefully that the skier is at a height greater than or equal to 4 when x satisfies the following equation :

$$(x^2 - 10x + 16) (x - 10) \leq 0. \quad (\text{E})$$

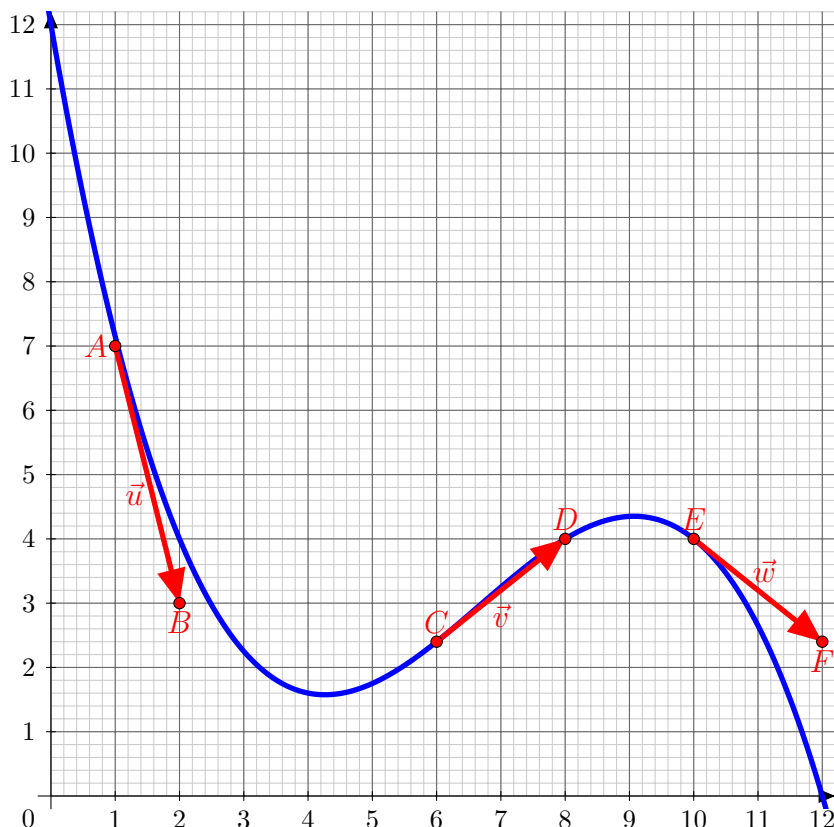
10. Find two integers a and b such that $a + b = -10$ and $ab = 16$.

Every sketch of reasoning is not necessary but welcome.

11. Deduce from the previous question a factorization of $(x^2 - 10x + 16)$.
12. (2 points) Deduce the tabular of sign of $(x^2 - 10x + 16) (x - 10)$ (see part III.2 of chapter 8 or example 14 of chapter 4).
13. Deduce the solutions of (E), that is to say the set of values of x for which the skier is at a height greater than or equal to 4.

Part III : vectors

The speed of the skier is represented by vectors whose direction indicates the one of the skier at the considered point and the norm of the vector is the numerical value of the speed of the skier.

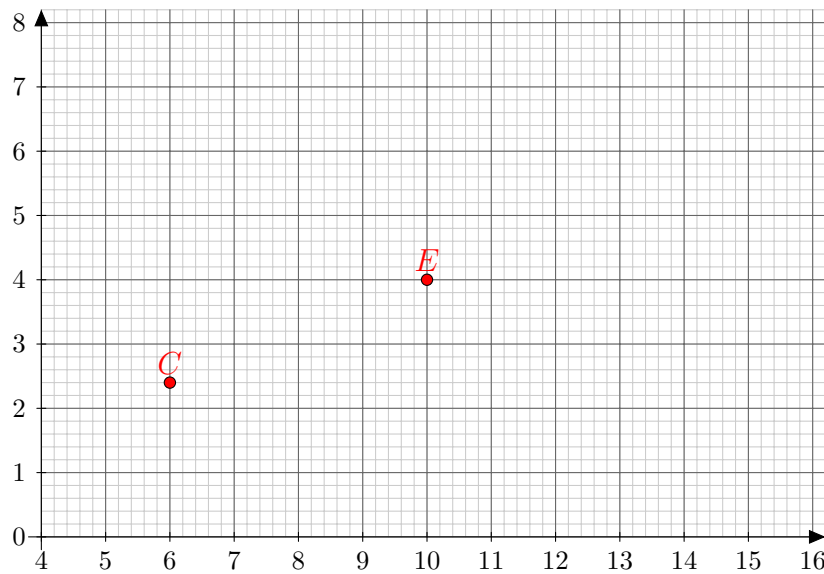




14. What are the coordinates of the vectors \vec{u} , \vec{v} and \vec{w} ?
15. Calculate the distances AB , CD and EF and deduce the norms of \vec{u} , \vec{v} et \vec{w} .
16. We assume that during a second run, the skier improves his speed. At the point C , let \vec{c} the vector of which the coordinates are $(3; 2, 4)$. Find λ the real such that $\vec{c} = \lambda\vec{v}$. What can we say about the vectors \vec{c} and \vec{v} ?
17. With this λ , calculate the coordinates of the vector \vec{e} defined by

$$\vec{e} = \lambda\vec{w}.$$

18. Draw the vector \vec{c} starting at C and the vector \vec{e} starting at E in the following graphic :



Part IV : statistics

The next page gives the 72 best Speed Skiing times ever recorded.

19. With the help of the next page, complete the following statistic tabular :

Speed (in km/h)	[230; 235[[235; 240[[240; 245[[245; 250[[250; 255[
Number of records					

20. **Using the previous tabular** and specifying the chosen representative number for each class, calculate the average speed records among these 72 results.
21. Which is the median? Justify.
22. Draw the histogram associated to the tabular above.

Our skier trains to the speed skiing and during his 25 last trainings, he exceeded 9 times the speed of 232,3 km/h.

23. Justify that it is possible to construct a prediction interval associated to these data, at level 95% and construct a such interval.

200_{KPH} SPEED SKI CLUB

LIFE TIME MEMBERS

KL/S1 – Men

Rk.	Name	Nat.	Speed	Place	Year
1	ORIGONE Yvan	ITA	254,958	Vars	2016
2	ORIGONE Simone	ITA	252,987	Vars	2016
3	BILLY Simon	FRA	252,809	Vars	2016
4	GOITSCHEL Philippe	FRA	250,696	Les Arcs	2002
5	MORET Jonathan	SWI	250,174	Les Arcs	2006
6	MAY Philippe	SWI	250,000	Les Arcs	2006
7	SISTACK Laurent	FRA	249,653	Les Arcs	2002
8	VIITASAARI Jukka	FIN	248,791	Les Arcs	2006
9	SCHROTTSHAMMER Klaus	AUT	248,447	Vars	2016
10	EGGER Harry	AUT	248,105	Les Arcs	1999
	MONTES Bastien	FRA	248,105	Vars	2014
12	ANDERSON Ross	USA	247,934	Les Arcs	2006
	LACHAUD Martin	FRA	247,934	Les Arcs	2006
14	PIMKIN Nikolay	RUS	247,763	Vars	2016
15	WICKMAN Roger	SWE	247,253	Les Arcs	2006
16	KRAMER Manuel	AUT	246,914	Vars	2016
17	HEMBEL John	USA	246,238	Les Arcs	2002
18	SCHULTZE Tor	SWE	245,734	Les Arcs	2006
19	JANSSON Christian	SWE	245,566	Vars	2015
20	PONCIN Marc	GBR	245,232	Les Arcs	2005
21	ROUSSEAU Johan	FRA	245,065	Les Arcs	2005
22	WIRKLER Chris	USA	244,898	Les Arcs	2006
23	DOBROWOLSKI Jędrzej	POL	244,233	Vars	2016
24	BILLY Philippe	FRA	243,902	Vars	1997
	VUNDERINK Meryn	NED	243,902	Les Arcs	2005
26	GOUMOENS Michel	SWI	243,408	Les Arcs	2005
	PERROUD Serge	FRA	243,408	Les Arcs	2006
28	HAMILTON Jeffrey	USA	242,915	Les Arcs	1997
29	HOCHRAINER Martin	AUT	242,751	Les Arcs	2006
	CERMAK Radek	CZE	242,751	Vars	2014
31	STAVIK Finn Arne	NOR	242,588	Les Arcs	2005
32	DUNSER Adi	GER	242,424	Les Arcs	2006
33	CASSANI Manolo	ITA	242,260	Les Arcs	2006
34	AUBONNET Stéphane	FRA	241,935	Les Arcs	2002
	SHUMILIN Mikhail	RUS	241,935	Vars	2016
36	KUSUMI Kazunaga	JAP	241,611	Les Arcs	1997
37	BROCKTON Nigel	GBR	241,449	Les Arcs	2005
38	GRAF Jurg	SWI	241,287	Les Arcs	2006
39	BILLY Louis	FRA	241,125	Vars	2015
40	ADARRAGA Riccardo	SPA	240,642	Vars	2014
41	ENGEL Beat	SWI	240,481	Les Arcs	2002
42	BREZAVSCEK Ales	SLO	240,160	Les Arcs	2002
43	BUDIN Pascal	FRA	240,000	Les Arcs	1999
44	RUPPRECHT Pup	USA	239,840	Vars	1997
45	OJALA Jouni	FIN	239,362	Vars	1995
	THIEBAUD Yves	SWI	239,362	Les Arcs	1999
47	JOKIPII Jyrki	FIN	239,043	Vars	1997
48	ROW Charlie	USA	238,568	Vars	1997
49	JONSSON Bengt	SWE	238,095	Vars	1997
	MONTES Jimmy	FRA	238,095	Vars	2014
51	MICHAUD Laurent	SWI	237,624	Les Arcs	2005
52	DUGAN John	USA	237,310	Les Arcs	1999
	DEGAND Serge	FRA	237,310	Les Arcs	2005
54	RINTALA Jukka	FIN	236,998	Vars	1997
55	MAGILL Timothy	USA	236,686	Les Arcs	2006
56	TAMMELA Marku	FIN	236,531	Les Arcs	1997
57	ORAIN Michaël	FRA	236,375	Vars	1995
58	BIANCO Eric	SWI	235,911	Vars	1997
59	BOLLON Nicolas	FRA	235,602	Vars	1996
60	DEVENES Ismael	SWI	235,294	Vars	2014
61	WACKLIN Henri	FIN	234,986	Vars	1995
62	GAREY Justin	CAN	234,834	Les Arcs	2006
	EIGENMANN Reto	SWI	234,834	Vars	2016
64	AUVINEN Ville	FIN	234,223	Les Arcs	1997
65	LAURENT Thierry	FRA	234,070	Les Arcs	2005
66	KEMPPAINEN Tuukka	FIN	233,312	Les Arcs	2002
67	GEBBIE Chris	NZE	232,859	Les Arcs	2005
68	DUREY Laurent	FRA	232,708	Les Arcs	2002
	JACOBSSON Magnus	SWE	232,708	Les Arcs	2002
70	METRAUX Jean-Louis	SWI	232,408	Les Arcs	2005
	RENALDO Antonio	ITA	232,408	Vars	2015
72	SCHRATT Robert	GER	232,258	Vars	1997