Surname :

First name :

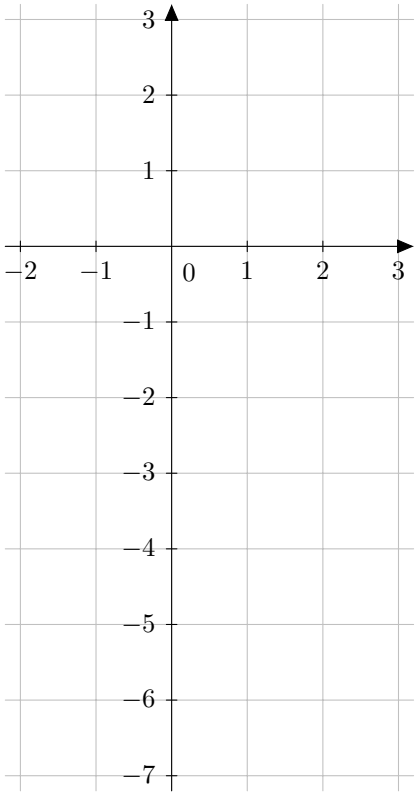
Training Test 5
Affine functions and sampling

The candidate has to pay attention to the presentation and to the clarity of his reasoning. Exercises are independent. ***Calculator allowed****.*

Exercice 1. *(7 points).* We consider the six following functions.

$$f_1(x) = \frac{2x+6}{3} \qquad f_2(x) = 5x^2 + 4x - 7 \qquad f_3(x) = 3(x+5) + 4\left(\frac{1}{2}x - \frac{5}{4}\right)$$
$$f_4(x) = \sqrt{x^2+3} \qquad f_5(x) = -4 \qquad f_6(x) = 9x - 5 - 7x + 2.$$

1. Develop and simplify f_3.
2. Among these six functions f_1, f_2, f_3, f_4, f_5 et f_6, which ones are affine functions ?
3. When the function is affine, give the slope (meaning the director coefficient) and the y-intercept (the y-coordinate when $x = 0$).
4. Which function is linear ? Justify.
5. Which function is constant ? Justify.
6. Calculate $f_6(3)$ et $f_6(-1)$. *You can start by simplifying the expression of* f_6.
7. Draw below the graph $\mathscr{C}_{f_6}$ of the function f_6.



Exercice 2. *(7 points).*

During a former study, a famous American newspaper estimated in 2013 that 42% of Americans older than 18 years-old considered that helping other people was a good way to feel happier. In order to check if this proportion is always correct, the newspaper made an important survey on its readers and on 801 Americans older than 18 years-old answering, 272 are agreed with the fact that help other people is a good way to feel happier.

1. Who is the population and the data to which we are interested in ?
2. What criticism can be made on the realisation of the survey ?
3. What is the **measured** frequency f of Americans who agree with this assertion ?
4. What is the size n of the sample and the theoretical proportion p of Americans who agree with this assertion ?
5. Deduce the associated prediction interval.
6. *(2 points)* Conclude if the study confirms the proportion of 2013 or if the Americans opinion seems to have changed.

Exercice 3. *(6 points).*

Extrait du tableau de Luc-Olivier Merson (1869)

Selon la légende, après leur éclatante victoire contre les Perses dans la plaine de Marathon, les Grecs envoyèrent Phidippidès annoncer la bonne nouvelle à Athènes. Celui-ci partit et courut à vitesse constante. On note $d(x)$ la distance parcourue par Phidippidès au temps x après son départ de Marathon. On fait l'hypothèse qu'au bout de $x_A = 1h05$, Phidippidès a déjà parcouru 19 km et on suppose la fonction d affine.

1. Donner l'ordonnée à l'origine de d.
2. Quelle est la nature **exacte** de d ?
3. Convertir x_A en minutes.
4. Calculer le coefficient directeur de d.
5. Soit x_F le temps qu'a mis Phidippidès pour arriver à Athènes. Exprimer $d(x_F)$ en fonction de x_F.
6. Sachant que la distance totale entre Marathon et Athènes est de 42 km, calculer x_F.