SINGAPORE POLYTECHNIC
2019/2020 SEMESTER ONE MID-SEMESTER TEST

Foundation Year

FOUNDATION MATHEMATICS Time allowed: 1.5 hr

Instructions:

1. The Singapore Polytechnic Examination rules are to be complied with.
2. This paper consists of **3** printed pages.
3. Unless otherwise stated, all decimal answers given should be correct to 3 significant figures.
4. Answer **ALL** the questions in the answer booklet provided.

1. Simplify the given expressions and express all answers in positive exponent form:

(a) $\left(\frac{4xy^2h^6}{7}\right)\left(\frac{x^3}{12h}\right)$ [4]

(b) $\left(4d^4\right)^{-2}\left(2k\,d^{-1}\right)^3$ [5]

(c) $\left(\sqrt{25(w+x)^{3a}}\right)^6\left(\frac{5^{-4}}{(w+x)^2}\right)$ [6]

2. (a) Find $(5x+3y)^2-(5x-3y)^2$. [4]

(b) Given that $Q(x)$ is a function in x and R is a constant, find $Q(x)$ and R such that $\frac{x^3-x^2+2x+3}{x-2}=Q(x)+\frac{R}{x-2}$. [6]

(c) Factorise $12p^4-4p^3-8p^2$ completely. [3]

(d) $(x-3)$ is a factor of the polynomial $3x^3+ax^2+bx+12$ which has a remainder of -12 when divided by $(x+1)$. Determine the values of a and b. [10]

3. Perform the indicated operations and simplify your answers.

(a) $\frac{x^2+8x+12}{3x}\div\frac{x+6}{6x^3}$ [5]

(b) $\frac{1}{3-x}-\frac{x}{x^2-9}$ [4]

(c) $\dfrac{2+\frac{2}{x-1}}{3+\frac{3}{x-1}}$ [6]

4. Express $\frac{5x^2+3-x}{x\left(x^2+1\right)}$ in partial fractions. [10]

5. (a) Explain if the relation {(1, 2), (2, -3), (3, 1), (1, 4)} defines *y* as a function of *x*. [2]

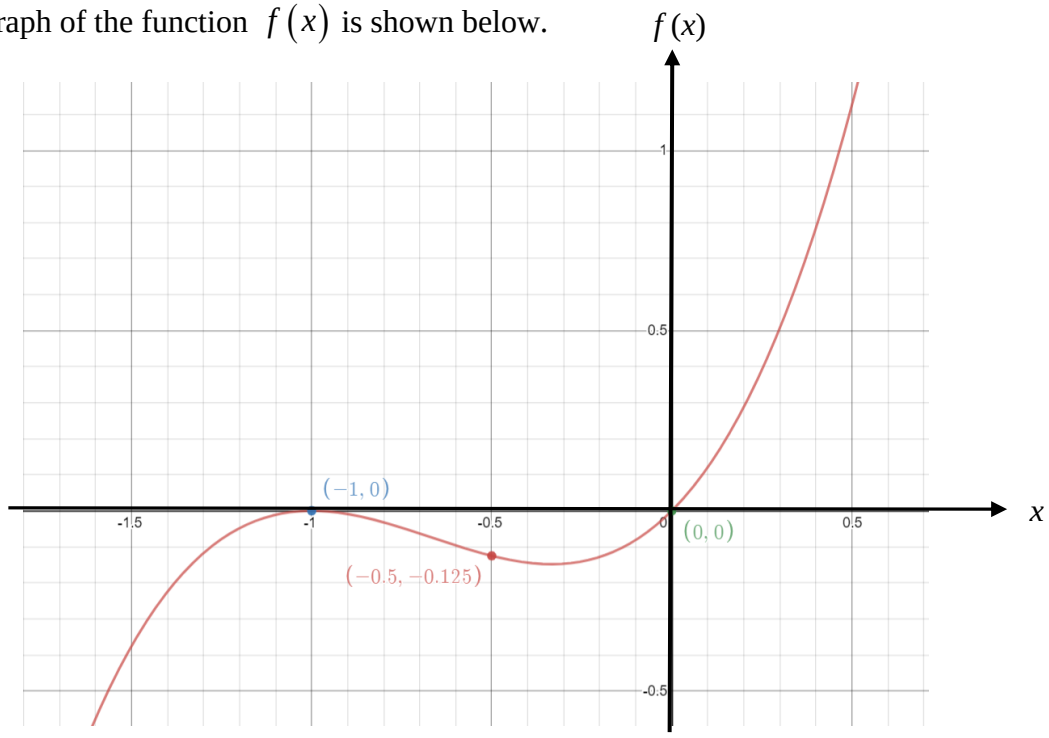
(b) Given the function $g\left(x\right)=x^2+2$,

(i) evaluate $g\left(-3\right)$. [2]

(ii) Determine $g\left(x-2\right)$. [3]

(iii) The graph of $g\left(x\right)$ is shifted 2 units to the right, stretched vertically by a factor of 3 and shifted 5 units upward. Determine the equation of the graph after going through the above transformations. [4]

6. A graph of the function $f\left(x\right)$ is shown below.



(a) State the values of $f\left(-1\right)$ and $f\left(-0.5\right)$. [2]

(b) What does $f'\left(-1\right)$ mean? Determine the value of $f'\left(-1\right)$. [2]

(c) State the domain and range of $f\left(x\right)$. [2]

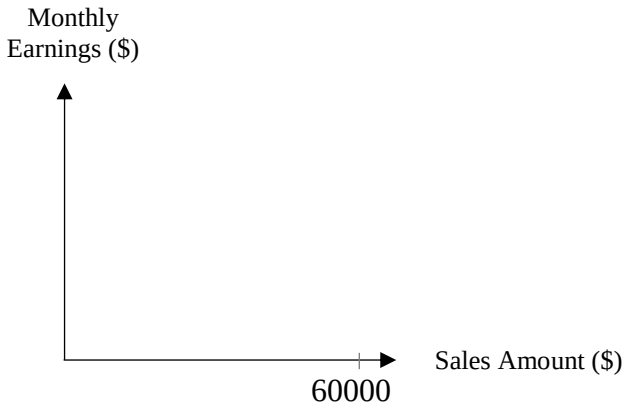
(d) Find a polynomial of degree 3 that describes the above graph. [5]

7. The monthly earnings of a salesperson is the sum of the basic salary and the commission on his sales amount. Johnson and Willy are two salespersons with different basic salaries and commission rates. Johnson's basic salary is \$800, and his commission is m % of sales. Willy's basic salary is \$1300 with no commission for sales less than \$30000. His commission is 4.5% of sales exceeding \$30000.

   (a) In April, Johnson's sales amount was \$50000 and his monthly earnings was \$3300. Determine the value of m. [5]

   (b) In the following month, Johnson's sales amount dropped. However, he had the same sales amount and monthly earnings as Willy.
   Calculate Johnson's sales amount in May. [6]

   (c) Copy the following graph to your answer booklet. Sketch the graph of the monthly earnings of Johnson and Willy up to a sales amount of \$60000. [4]



END OF PAPER