SINGAPORE POLYTECHNIC
2018/2019 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.

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

   (a) $\left(5p^0r^2h^5\right)\left(\dfrac{r^3}{15ph^2}\right)$ [4]

   (b) $\left(wd^2\right)^3\left(w^5d^{-1}\right)^{-1}$ [5]

   (c) $\left(8\sqrt{k^{12}}\right)^{\frac{1}{3}} \div \left(\dfrac{4}{k}\right)$ [6]

2. (a) Factorize the following expressions completely:

   (i) $x^2\left(5x-2\right)+7\left(5x-2\right)$ [2]

   (ii) $\left(x-3\right)^{\frac{1}{2}}-\left(x-3\right)^{\frac{3}{2}}$ [4]

   (b) Perform the following operations and simplify your answers:

   (i) $\dfrac{2}{a^2+a}+\dfrac{3}{a^2-1}$ [6]

   (ii) $\dfrac{3x}{25-x^2}\bullet\dfrac{x-5}{6x^2}$ [4]

   (iii) $\dfrac{1}{\dfrac{1}{R}+\dfrac{1}{2R}+\dfrac{1}{4R}}$ [4]

3. Express $\dfrac{3x^2-4x+7}{\left(x-1\right)\left(x^2+2\right)}$ in partial fractions. [10]

4. (a) Solve $x^2-4x+3=0$ for x. [3]

   (b) Using **<u>completing the square,</u>** find the exact value(s) of x that satisfy the equation $4x^2+12x=11$. [7]

5. (a) Find the quadratic function of the parabola with vertex of (1, 2) and passing through the point (3, 4). [5]

(b) Sketch the graph for the function found in (a), clearly indicating all intercepts. [2]

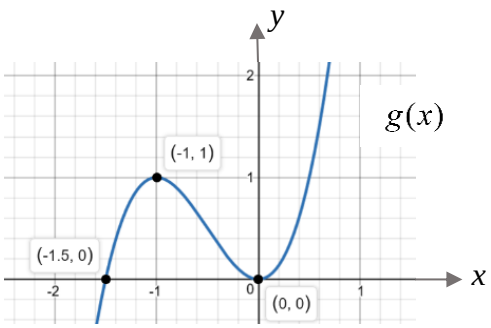
(c) Using the graph or otherwise, state the domain and range. [3]

6. (a) Given the function $f(x)=1-x+3\sqrt{x}$.

(i) Evaluate $f(4)$. [2]

(ii) Find $f(x+1)$. [2]

(b) A graph of the function $g(x)$ is shown below.

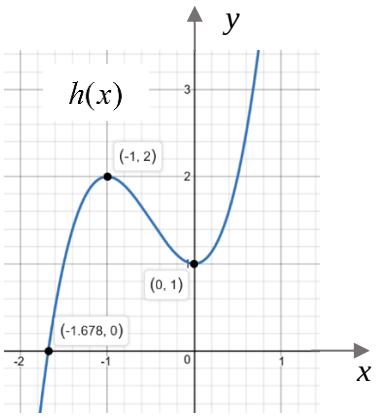


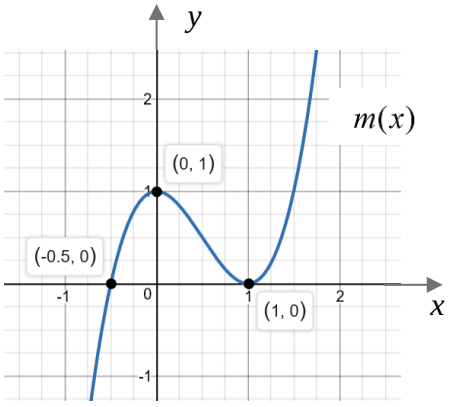
(i) Find $g(-1.5)$ and $g(0)$. [2]

(ii) Will $g'(-1.5)$ be greater than, equal to or less than $g'(0)$?

Explain your answer. [2]

The following are graphs of functions, $h(x)$ and $m(x)$ which are transformed from $g(x)$.





(iii) Describe how the graphs of $h(x)$ and $m(x)$ can be obtained from the graph of $g(x)$.

Hence, determine the functions $h(x)$ and $m(x)$. [4]

6. (c) A reciprocal function $y = \frac{1}{x}$ is transformed in the following order:

- Shifted one unit to the left.
- Shrink vertically by a factor of $\frac{1}{2}$.
- Shifted two units down.

Write the equation of the graph after undergoing the above transformations. [3]

7. A grocery shop owner has 1000 bottles of milk that he wishes to sell in a month. It is known that the demand quantity for milk, D, is related to the selling price of milk, P, by $D = -400P^2 + 400P + 3400$. Given that all bottles are sold and the cost price per bottle of milk is \$1, find the maximum profit the owner makes at the end of the month. [10]

8. Mr Chan is married with 1 child and his wife is not working. In 2017, the income tax payable by him was \$625. The tables below list the tax rates and the amounts of relief he was entitled to. Calculate his gross annual income for 2017, rounding your answer to the nearest dollar. [10]

Note that chargeable income = gross annual income – total reliefs.

Chargeable Income (\$)	**Tax Rate (%)**
On the first 30000	1.0
On the next 10000	3.5

Type of relief	**Amount**
Personal	\$5000
Unemployed spouse	\$2000
Child	\$2000 per child
Insurance premiums	\$1000
CPF contributions	\$10000

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