SINGAPORE POLYTECHNIC
2021/2022 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 **2 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) $\left(\dfrac{3a^0(-b)^2}{c^2}\right)\left(\dfrac{c^6}{6ab^4}\right)$ [5]

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

   (c) $\left[\dfrac{27}{\left(2q^2\right)^3}\right]^{\frac{1}{3}} \div \dfrac{4}{\sqrt{q^{16}}}$ [5]

2. (a) Simplify $(x-16y)^2-(x+16y)^2$. [4]

   (b) Find the quotient and remainder when $3x^3 + 4x^2 - 5x - 7$ is divided by $3x + 1$. [6]

   (c) Factorise $\left(a^2-2\right)^2-3\left(a^2-2\right)-28$ completely. [5]

   (d) The expression $2x^3 - 3x^2 + px + q$ has a factor of $x + 2$ and leaves a remainder of 6 when divided by $x - 1$. Determine the values of p and q. [10]

3. Perform the indicated operations and simplify your answers.

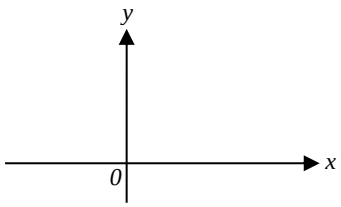
   (a) $\dfrac{3p-5q}{p^3q^{10}} \times \dfrac{8p^5q^7}{6p-10q}$ [4]

   (b) $\dfrac{1}{6-2a} - \dfrac{a}{a^2-9}$ [6]

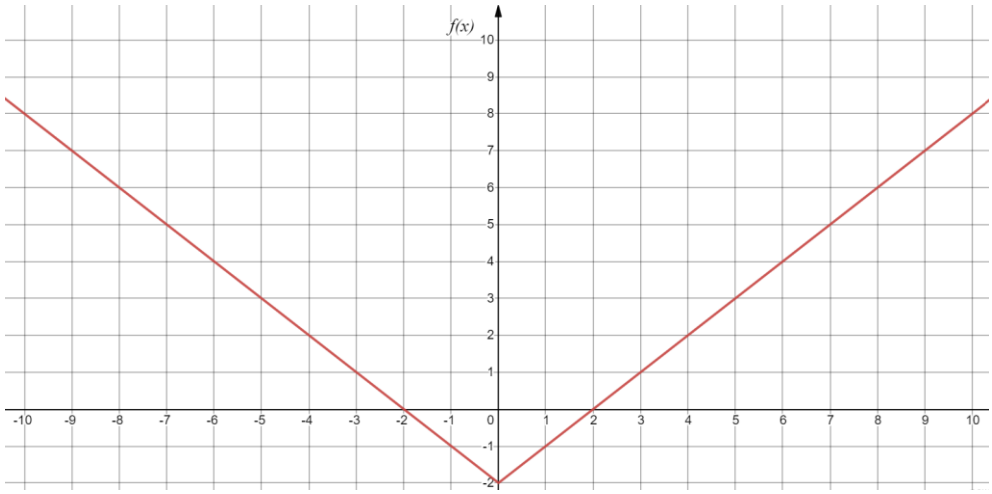
   (c) $\dfrac{1+\dfrac{1}{R}}{\dfrac{1}{R}+\dfrac{1}{2R}}$ [5]

4. Express $\dfrac{5x^2-5x+6}{(x-2)\left(x^2+4\right)}$ in partial fractions. [11]

5. Copy the below axes into the answer booklet and sketch a graph that is **not a function.** [2]



6. (a) Given the following graph $f(x) = |x| - 2$, explain if $f(x)$ is a function. [2]



(b) State the corresponding values for $f(-6)$ and $f(3)$. [2]

(c) Find all x for which $f(x) = 2$. [2]

(d) State the coordinates of the x-intercept(s). [2]

(e) State the coordinates of the y-intercept. [2]

(f) Determine the domain of $f(x)$. [2]

(g) Determine the range of $f(x)$. [2]

(h) Sketch the graph of $g(x) = f(x) + 3$, clearly showing the y-intercept. [3]

7. (a) Motorboat M1 went **downstream** in a river and covered a distance between two coastal towns in 5 hours. It covered this distance **upstream** in 6 hours. If the speed of the stream was 3 km/hr, find the speed of motorboat M1 in still water. [10]
(Hint: Take into account the speed of the motorboat in still water and the speed of the stream when determining the speed of the motorboat upstream or downstream.)

(b) Assuming the same set of conditions mentioned and obtained in part (a), it was known that motorboat M1 had left the coastal town **upstream** at 12pm. The speed of another motorboat M2 upstream was 40 km/hr, and had left that same coastal town upstream 15 minutes later, travelling in the same direction as motorboat M1. At what time of the day will the two motorboats meet on the river? [5]

END OF PAPER