Test Three

This is a self-diagnostic test. Every pair of questions relates to a worksheet in a series available in the MUMS the WORD series. For example question 5 relates to worksheet 3.5 *Simultaneous Equations*. If you score 100% on this test and test 4 then we feel you are adequately prepared for your first year mathematics course. For those of you who had trouble with a few of the questions, we recommend working through the appproriate worksheets and associated computer aided learning packages in this series.

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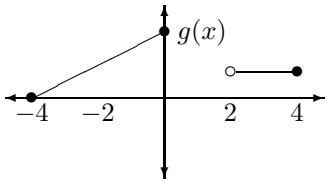
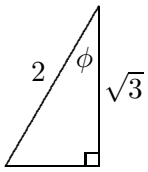
1. (a) If $f(x) = x^2 + 2$, what is $f(3x)$?
   (b) If $g(x) = x^2$, and $f(x) = 2x + 1$, what is $g \circ f(x)$?

2. (a) What is the domain of $g(x)$ in the following graph?

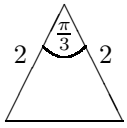


   (b) At what points on the graph above does $g(x) = 0$?

3. (a) If an angle is $60°$, how many radians is it?
   (b) For the $\triangle$ drawn below, what is the angle ϕ?



4. (a) What is $\sin \frac{7\pi}{4}$? (Without a calculator)
   (b) Find the area of the triangle drawn below.



5. (a) Given:

$$\begin{aligned} y &= 2x + 5 \\ y &= kx + 4 \end{aligned}$$

For what value(s) of k will the system have no solutions?

(b) Solve the system:

$$\begin{aligned} y &= 3u + 6 \\ 3y &= 5u + 2 \end{aligned}$$

6. (a) If $2, 7$ are the first two terms of an arithmetic progression, what is the 10th term?

(b) What is the sum of the following infinite geometric series?

$$1 + \frac{9}{10} + \frac{81}{100} + \dots$$

7. (a) Find the limit of

$$\lim_{n \to 5} \frac{x^2 - 25}{x - 5}$$

(b) Is the function

$$f(x) = \begin{cases} \frac{x^2+6}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

continuous at $x = 0$? Why?

8. (a) Find the derivative of $f(x) = x^3 + 3x^2 + 3$.

(b) What are the stationary points of the function $g(x) = x^3 + 3x^2$?

9. (a) What sort of turning points does the function $f(x) = 6 - 3x^2$ have?

(b) When does the concavity change for the function $h(x) = x^3 + x^2 + 5x + 2$?

10. (a) Differentiate $y = \sin(5x + 3)$.

(b) Differentiate $y = 3e^x$.

Answers to Test Three

1. (a) $9x^2 + 2$
   (b) $(2x + 1)^2$
2. (a) $[-4, 0] \cup (2, 4]$
   (b) $x = -4$
3. (a) $\frac{\pi}{3}$
   (b) $\phi = \frac{\pi}{6}$
4. (a) $-\frac{1}{\sqrt{2}}$
   (b) $\sqrt{3}$
5. (a) $k = 2$
   (b) $u = -4,\ y = -6$
6. (a) 47
   (b) 10
7. (a) 10
   (b) No
8. (a) $3x^2 + 6x$
   (b) $(0, 0),\ (-2, 4)$
9. (a) Max
   (b) $x = -\frac{1}{3}$
10. (a) $5\cos(5x + 2)$
    (b) $3e^x$