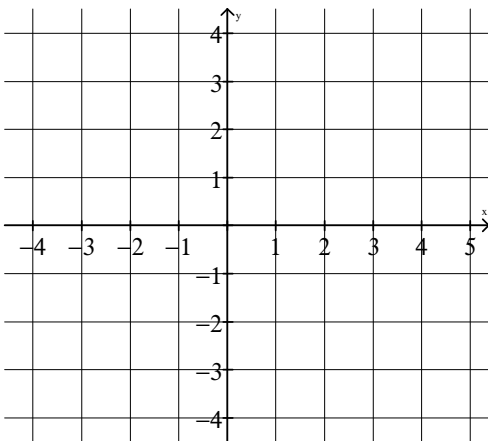


**PART A - ANSWER IN THE SPACE PROVIDED.**

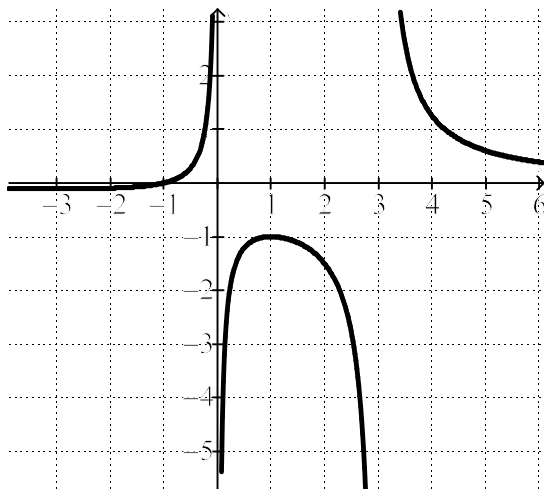
Each correct answer is worth one mark (42 marks).

1. Give the remainder when  $2x^2 + x + 4$  is divided by  $(x - 1)$ . \_\_\_\_\_2.  $(x + a)$  is a factor of  $f(x)$  when  $f(a) = 0$ . True / False3. Factor  $27a^3 - 64$  \_\_\_\_\_4. The graph of  $g(x) = \frac{x^2 + 3x + 2}{x^2 + x - 2}$  has :i) a hole at  $x =$  \_\_\_\_\_

ii) an asymptote at \_\_\_\_\_

iii) as  $x \rightarrow \infty$  then  $y \rightarrow$  \_\_\_\_\_iv) as  $x \rightarrow -\infty$  then  $y \rightarrow$  \_\_\_\_\_

v) sketch the function at the left.

5. If  $f(a) = f(-a)$  the function is *odd*. True / False6. Given  $f(x)$  below:a)  $\lim_{x \rightarrow 3^-} f(x) =$  \_\_\_\_\_b)  $\lim_{x \rightarrow 1^+} f(x) =$  \_\_\_\_\_c)  $\lim_{x \rightarrow 3^+} f(x) =$  \_\_\_\_\_d)  $\lim_{x \rightarrow 0} f(x) =$  \_\_\_\_\_7. Solve  $|-5x| < 20$  \_\_\_\_\_

8. Simplify each expression.

a)  $(\sqrt[3]{x})^4(x^2)$  \_\_\_\_\_

b)  $\frac{6m^{\frac{1}{4}}n^{\frac{-1}{3}}}{10m^{\frac{3}{2}}n^{\frac{1}{2}}}$  \_\_\_\_\_

9. Write in radical form  $(b^5)^{\frac{2}{3}}$  \_\_\_\_\_

10. Answer each question below.

i) Given  $y = a^x; a > 0$  a) the range is \_\_\_\_\_

b) the equation of the asymptote \_\_\_\_\_

c) as  $x \rightarrow -\infty$  then  $y \rightarrow$  \_\_\_\_\_

d) If  $a = 1$  then the y-int = \_\_\_\_\_

11. Write  $w = a^z$  in logarithmic form. \_\_\_\_\_

12. Given  $y = -\log_2(x-4) + 1$  state:

a) the domain \_\_\_\_\_

b) equation of the asymptote \_\_\_\_\_

c) Given  $P(x,-1)$  then  $x =$  \_\_\_\_\_

13. A logarithmic function is a reflection of an exponential function in the line  $y = x$ . True / False

14. Which expression is equal to  $3 \log 4$ ? \_\_\_\_\_

a) 12      b)  $\log 12$       c) 64      d)  $\log 64$       e)  $(10^4)^3$

15. If  $3^x = 18$  then  $x =$  \_\_\_\_\_(2 d.p.)

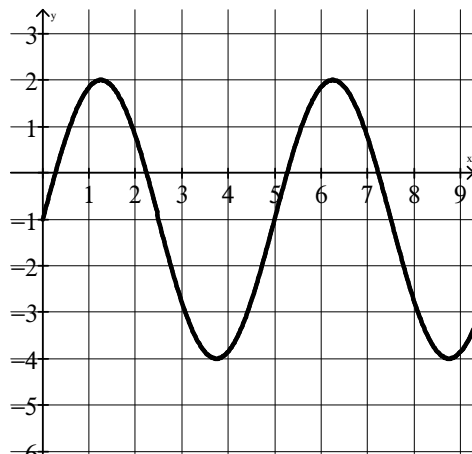
16. The ph of vinegar is 2 units less than that of a tomato. Which statement is true? \_\_\_\_\_

- a) A tomato is twice as acidic as vinegar.
- b) Vinegar is twice as acidic as a tomato.
- c) A tomato is 100 times as acidic as a tomato.
- d) Vinegar is 100 times as acidic as a tomato.
- e) A tomato is half as acidic as vinegar.

17. Determine the exact value of  $\cos \frac{17\pi}{4}$  \_\_\_\_\_

18. Evaluate  $\tan 4^r$  (2 d.p.) \_\_\_\_\_

19. Given the sketch below of  $f(x)$  determine:



a)  $f(x) =$  \_\_\_\_\_

b) Instantaneous rate at  $5 \doteq$  \_\_\_\_\_

c) Average rate between  $3 \leq x \leq 5$ . \_\_\_\_\_

20. Express  $40^\circ$  as an exact value in radians. \_\_\_\_\_

21. Solve  $\sin x = 1; 9\pi \leq x \leq 12\pi$ . \_\_\_\_\_

22. Write  $\sin 45^\circ \cos 15^\circ - \cos 45^\circ \sin 15^\circ$  as a single trigonometric function. \_\_\_\_\_

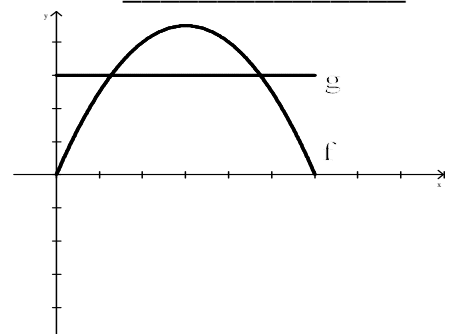
23. Express  $4 \sin \frac{x}{2} \cos \frac{x}{2}$  as a single trigonometric function. \_\_\_\_\_

24. Express  $\csc 2\theta$  in terms of  $\sin \theta$  and  $\cos \theta$ . \_\_\_\_\_

25. Given  $f(x) = -x^2$  and  $g(x) = -2x$  give  $f \circ g$  \_\_\_\_\_

26. a) Draw  $f - g$  on the graph at the right.

b) Evaluate  $(g \circ f)(3)$  \_\_\_\_\_

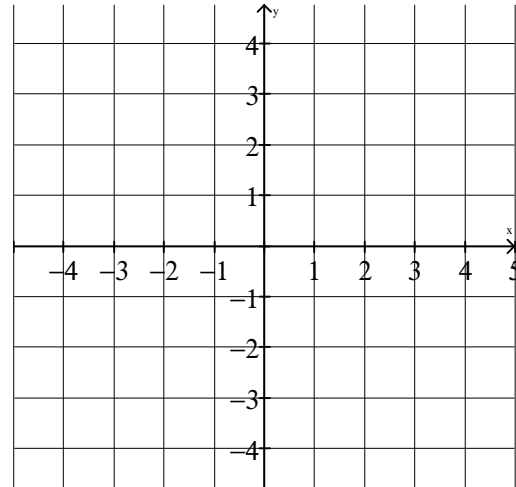


**PART B - ANSWER IN THE SPACE PROVIDED (74 Marks).**

27. Sketch the following function (show a minimum of two (2) points).

a)  $f(x) = -2^{x-1} - 2$

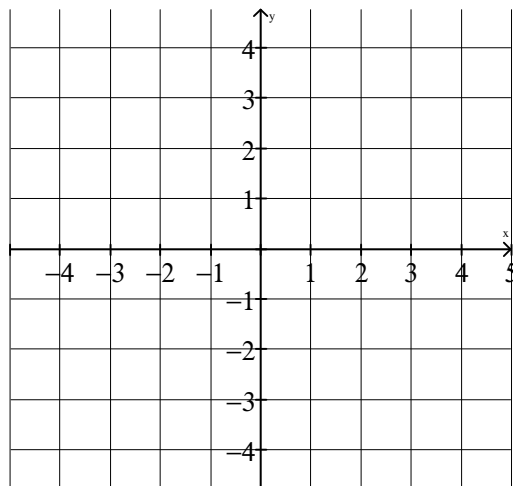
3



b) Sketch the inverse of 'a' above, and write its equation in logarithmic form.

2,1

$y =$  \_\_\_\_\_

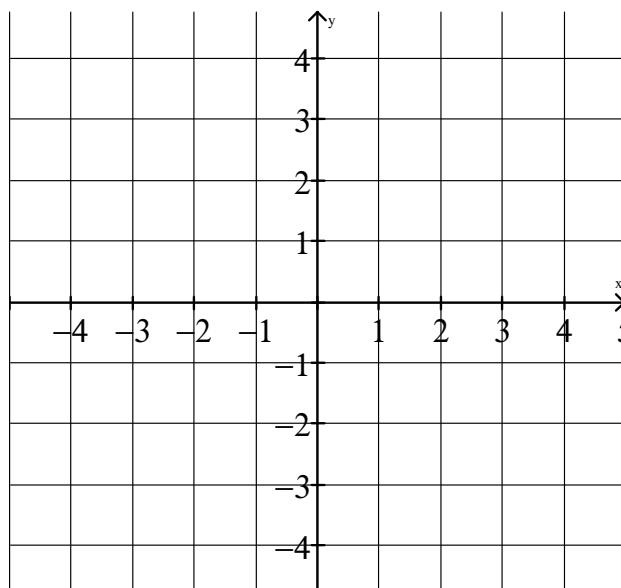


c) Sketch each on the grid at the right. Label each clearly.

2,2

a)  $y = 2\log_2 x$

b)  $y = -\log_2(x-1) + 3$



28. Evaluate each.

2,2

a)  $\log_3 \sqrt[4]{81}$

b)  $\log_8 48 + \log_8 4 - \log_8 3$

29. Solve  $\log_2(x-5) + \log_2(x-2) = 2$

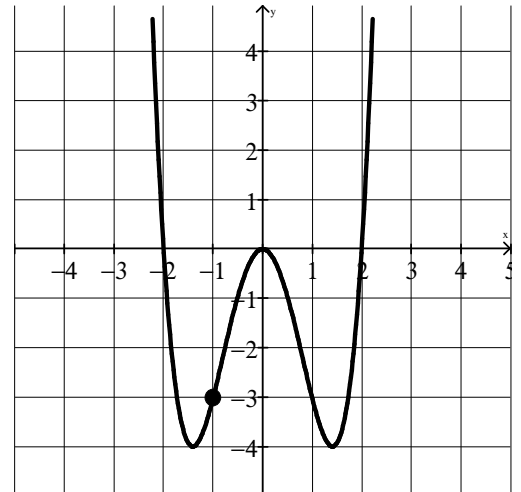
4

30. There were 1200 red ants in a particular colony. If there are 5400 ants in the colony in 8 months, what is the monthly rate of growth?

3

31. Determine an equation of the function shown below.

4



32. a) Use long division to determine the number of real roots and factor the function as far as possible, given  $f(x) = x^3 - 5x^2 + 7x - 3$ . State the roots.

3

b) Using  $f(x)$  above, determine the slope of the secant passing through the points given by:

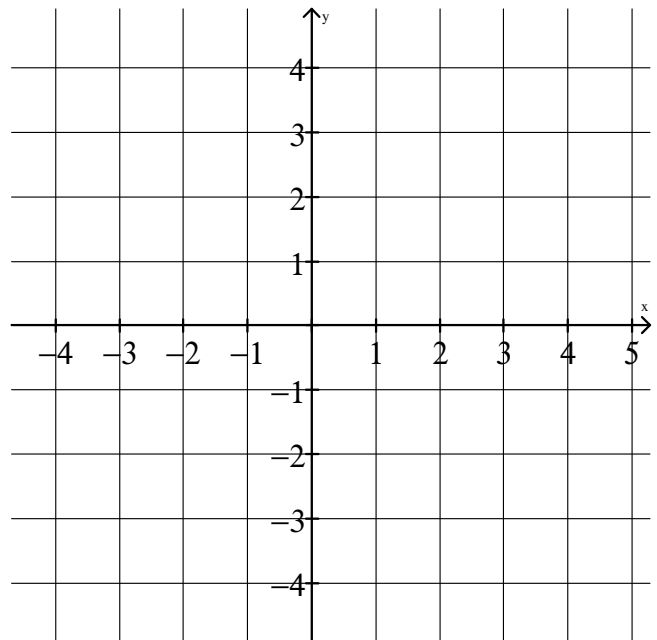
i)  $f(1)$  and  $f(1.1)$     ii)  $f(1)$  and  $f(1.05)$     iii)  $f(1)$  and  $f(1.0001)$

3

1 iv) Estimate the slope of the tangent at  $x = 1$ . \_\_\_\_\_

c) Sketch the function  $f(x) = x^3 - 5x^2 + 7x - 3$  using intercepts, end-behaviour **and** also using the information gathered in part 'b' regarding the slope of the tangent at  $x = 2.3$ .

3

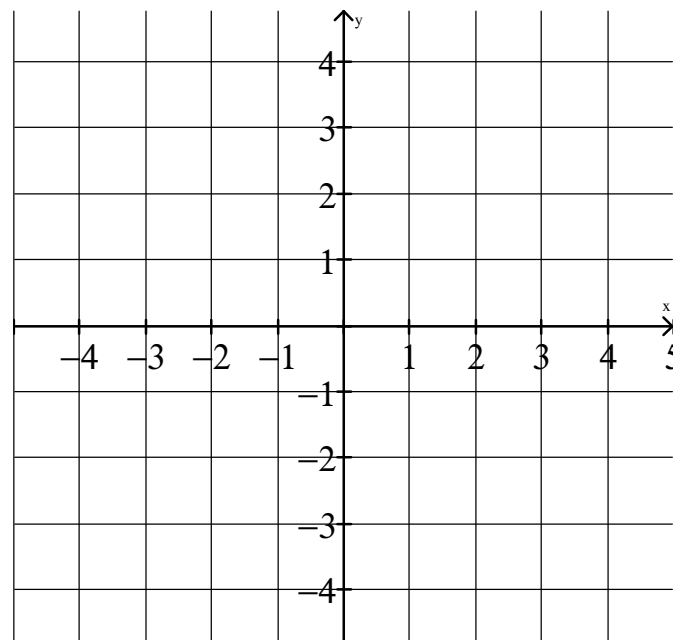


1 e) Solve  $x^3 - 5x^2 + 7x - 3 \leq 0$ . \_\_\_\_\_

33. Sketch each rational function.

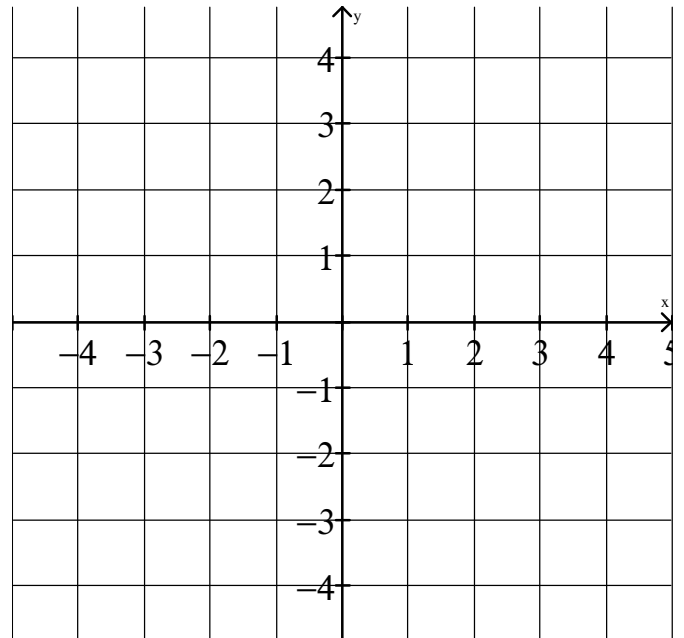
a) 
$$h(x) = \frac{x^2}{x^2 + x - 6}$$

4



$$\text{b) } g(x) = \frac{x^2 + 5}{x + 1}$$

4



34. Determine the general solution for the equation. Include a sketch.

$$\tan^2 2\theta + \tan 2\theta = 0$$

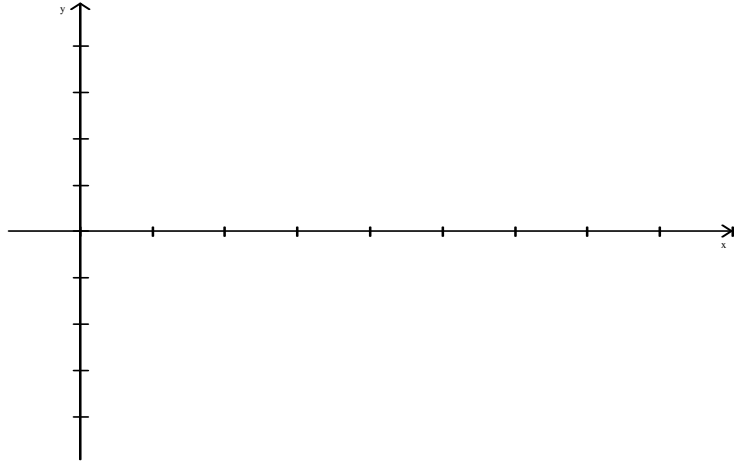
4



35. Graph each trigonometric function for one period.

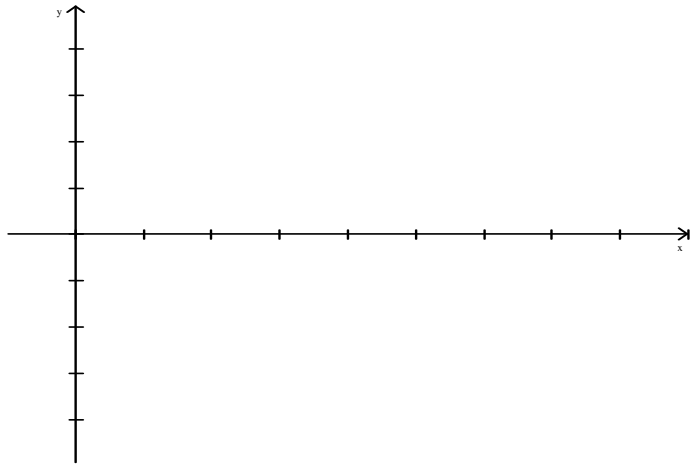
a)  $y = \frac{1}{2} \sec \theta - 1$

3



b)  $y = \cos 4\left(\theta - \frac{\pi}{3}\right) + 1$

4



36. Give the exact value of  $\sin \frac{\pi}{12}$ .

3

37. Prove each identity.

a)  $\frac{\sin 2x}{1 + \cos 2x} = \tan x$

b)  $\frac{\cos(x + y)}{\sin x \cos y} = \cot x - \tan y$

3,3

38. If  $\cos x = \frac{3}{5}$  and  $\cos \alpha = \frac{12}{13}$  where  $x$  and  $\alpha$  are both acute, find  $\sin(\alpha - x)$ .

4

39. Given  $f(x) = 2^x$  and  $g(x) = 3x - 4$  find  $g \circ f(x)$  and state the domain and range of  $g \circ f(x)$ .

3

40. A small town committee estimates that the population (P) of the town will change with respect to time,  $t$  in years according to the equation  $N = 5000\sqrt{1+t}$ . Estimate the *rate* at which the population will be increasing with respect to time at 3 years. Show all your calculations.

3