

1. Cobalt-60 has a half life of 5.3 years.
 - a) What fraction of an original sample will remain after 15.9 years?
 - b) How long will it take until there is only 25% of the original sample remaining?

2. The length and width of a rectangle is represented by $\frac{4x+1}{2}$ and $\frac{2x-3}{3}$. Write and simplify an expression that represents the perimeter of the rectangle in terms of x. Note: $P = 2(l + w)$

3. Evaluate **using power laws**. Do not use a calculator. Leave answer as a fraction.
 - a) $9^{\frac{1}{2}}$
 - b) $100^{-\frac{3}{2}}$
 - c) $81^{-\frac{3}{4}}$
 - d) $\left(\frac{8}{27}\right)^{\frac{2}{3}}$

4. A rectangle has side lengths of $4 + \sqrt{2}$ and $4 - \sqrt{2}$. Evaluate the area of the rectangle.

5. Solve and check.

a) $2^{x-3} = 16$ b) $9^{x+2} = 81$ c) $3^{g+3} - 3^{g+2} = 1458$

6. A helium filled balloon has a volume of $25\,000\text{ cm}^3$. It loses two fifths of helium every 24 h.

- a) Write a sequence giving the volume of helium at the beginning of each day for 4 days, including the first day.
- b) What is the common ratio for this sequence?
- c) What volume of helium will be in the balloon at the start of the sixth day?

7. Find the sum of the series $100 + 90 + 80 + \dots - 50$

8. Write an explicit formula for the sequence determined by each recursion formula.

a) $t_1 = -2; t_n = 4t_{n-1}$

b) $t_1 = -6; t_n = t_{n-1} - 4$

9. Answer the questions below for the following relation: $\{(-1,6), (0,-6), (1,-6), (2,-6)\}$

a) Is this relation a function? Explain.

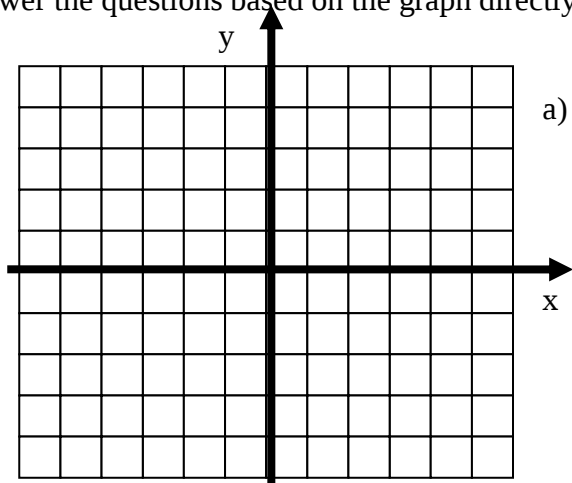
b) State the domain and range of the relation using the **same notation** as above.

c) If $\{(-1,6), (0,-6), (1,-6), (2,-6)\}$ are the ordered pairs of the function f , then find the ordered pairs of the inverse function, f^{-1} .

d) Is the inverse a function? Explain.

10. If $f(x) = 2x^2 - x - 9$, find $f(-2)$.

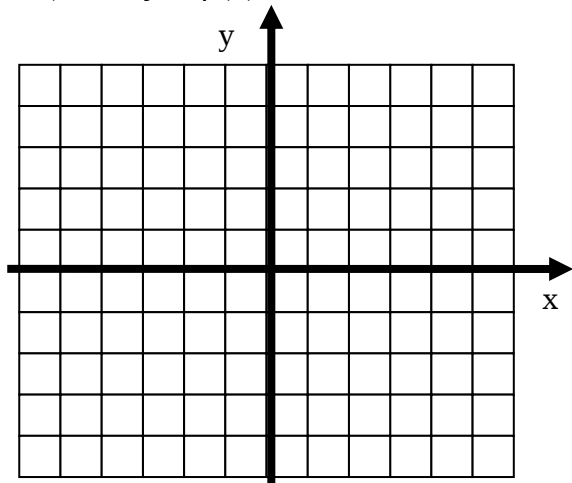
11. Answer the questions based on the graph directly below.



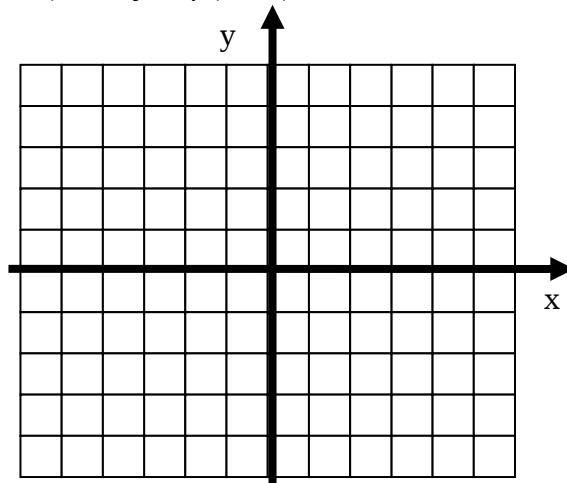
a) State the domain and range of this relation.

b) If the graph shown is $y = f(x)$, sketch each of the following functions on the grids provided. Be accurate with key points on the graph.

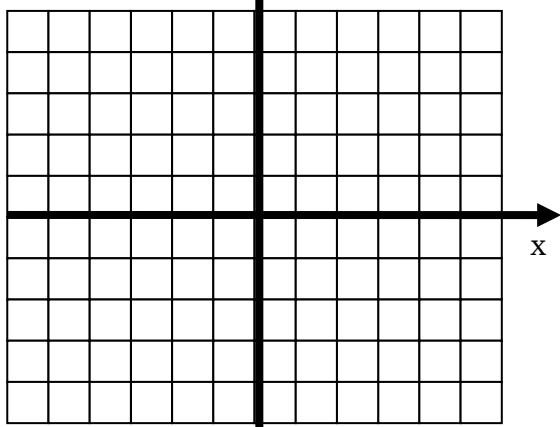
i) $y = f(x) + 3$



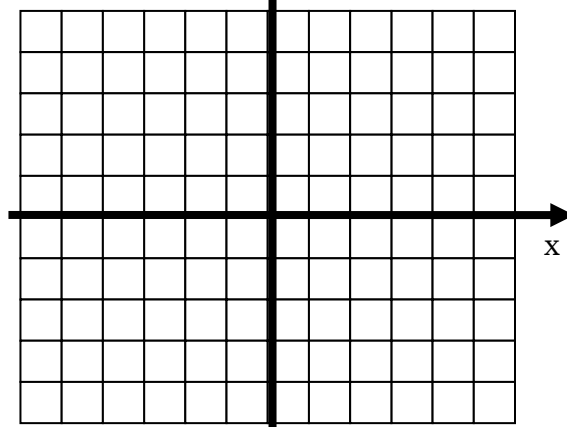
ii) $y = f(x - 2)$



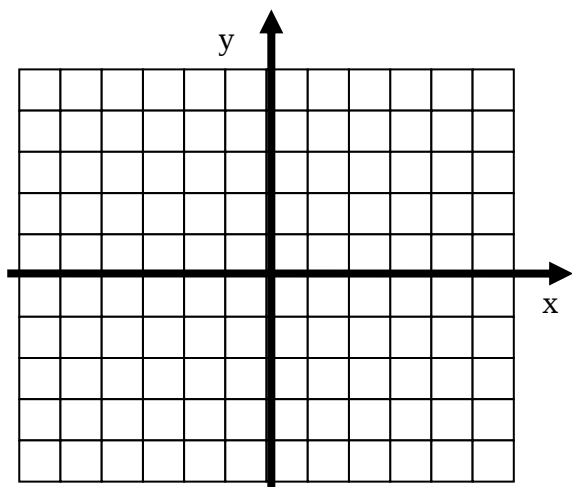
iii) $y = -f(x)$



iv) $y = f(-x)$



v) $y = f^{-1}(x)$



12. Using point form, describe how the graph of each of the following functions can be obtained from the graph of $y = f(x)$. List the transformations as they appear from left to right in the equation.

a) $y = 2f(x) - 4$

b) $y = f(2(x - 0.5))$

c) $y = -f(0.5x)$

d) $y = f(-\frac{1}{3}x)$

13. Evaluate $\frac{6^2 - 6^1}{5^{-1}}$.

14. Simplify. Express each answer with positive exponents.

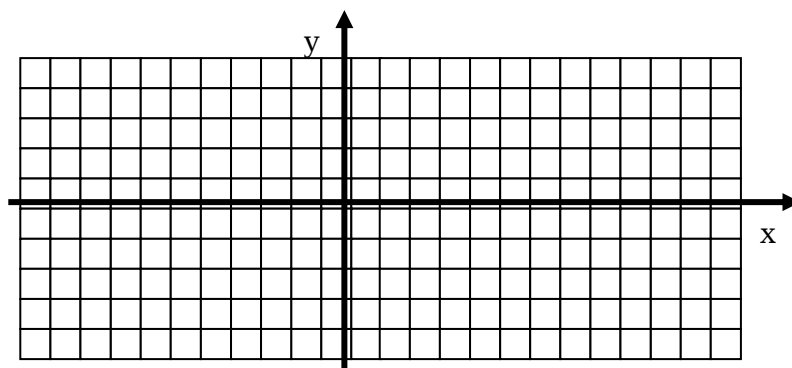
a) $\left(\frac{x^{-5}}{y^3}\right)^{-3}$

b) $\frac{20m^3n^{-2} \times 3m^{-1}n^4}{-4mn^{-3}}$

15. a) Describe the mathematical technique used to help recognize the characteristics of the function $y = (4x + 8)^2 + 7$.

b) Write the function after this technique.

16. Starting with $y = x^2$, sketch the graph of $y = -f(x - 4) + 3$.



17. Expand and simplify $2(x - 3)^2 - (2x + 1)(3x + 2)$.

18. Simplify. State any restrictions on the variables.

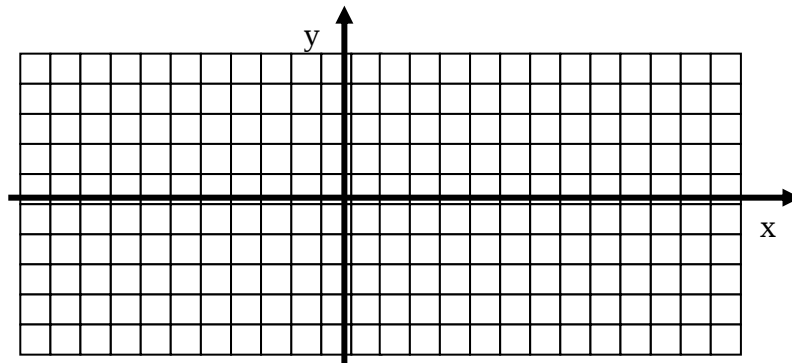
a) $\frac{2y^2 + 4y}{3y^2 + 6y}$

b) $\frac{2m^2 + m - 3}{3m^2 + 2m - 5}$

c) $\frac{t^2 + 4t + 4}{t - 2} \div \frac{3t + 6}{t^2 - 5t + 6}$

d) $\frac{2}{x^2 + 5x + 4} - \frac{3}{x^2 - 3x - 4}$

19. The “thick” graph, $f(x)$, is a transformation of the “thin” graph.



a) Find the equation of the “thick” graph.

b) State the domain and range of the thick graph.

20. Given $f(x) = x^2 - 11x + 7$,

a) Write the equation for $y = -f(x)$.

b) Write the equation for $y = f(-x)$.

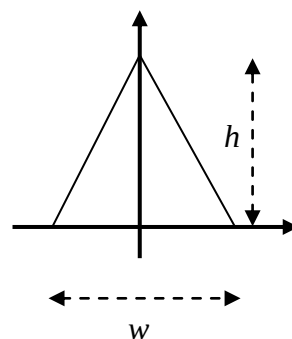
21. The diagram shows a set of coordinate axes superimposed on the cross section of a roof. The height of the roof is h metres and the width is w metres. The equation of one half of the cross section is $y = -2x + 7$.

a) Which half of the cross section is **LEFT** or **RIGHT** given by the above equation?

b) What is the equation of the other half of the cross section? $y =$ _____

c) What is the height of the roof, h ? **The height is** _____ m.

d) What is the width of the roof, w ? Show your work.



22. a) Complete all columns.

$y = f(x)$		$y = f(4x)$		$y = \frac{1}{4}f(x)$	
x	y	x	y	x	y
-2	0				
-1	2				
0	4				
1	3				
2	2				

- b) The graph of $y = f(4x)$ is a _____ of the graph $y = f(x)$.
- c) The graph of $y = \frac{1}{4}f(x)$ is a _____ of the graph $y = f(x)$.

23. a) Find the formula for the n th term that determines this sequence:

10 000, -5000, 2500, -1250, ...

- b) Find t_8 for this sequence.

24. a) In an arithmetic sequence, $t_8=166$ and $t_{12}=130$. Find the formula for the n^{th} term, t_n .

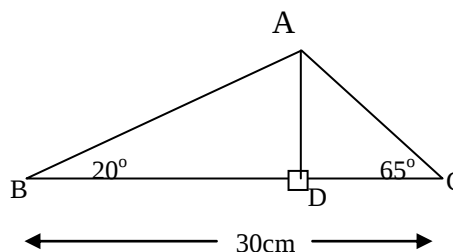
- b) Find the first three terms in the sequence.

25. The cost of renting a van for one day is a flat rate of \$65, plus a variable rate of \$0.15/km.
- Write a function to express the total cost of a one-day rental, $c(d)$ dollars, in terms of the distance driven, d kilometres.
 - Determine the inverse of the function.
 - What does the inverse represent?
26. Solve the triangle. Round each side length to the nearest tenth of a unit, and each angle to the nearest tenth of a degree: $\triangle KLM$, $\angle K = 90^\circ$, $m = 12.4\text{cm}$, $l = 8.8\text{cm}$.

27. The point $P(k, 24)$ is 25 units from the origin. If P is on the terminal arm of an angle in standard position, find, for **each** value of k ,

- the sine of the angle.
- the cosine of the angle.

28. Determine the measure of AD .



29. The length of the base of an isosceles triangle is 60 m. The angle opposite the base measures 32° . Find the perimeter of the triangle, to the nearest metre.
30. To measure the height of XY, of an inaccessible cliff, a surveyor recorded the data shown. If the height of the theodolite used was 1.7 m, find the height of the cliff, to the nearest tenth of a metre.
31. Expand the following:
- a) $(4x^2 + 8xy + 4y^2)^3$
- b) $(2x - 3)^4(2x + 3)^4$
32. The coordinates P on a terminal arm of an $\angle \theta$ in standard position are (7, -4), where $0 \leq \theta \leq 360$. Determine the exact values of $\sin \theta$, $\cos \theta$, and $\tan \theta$.
33. a) Find the inverse of the function $f(x) = (x + 2)^2$.
- b) Is the inverse a function? Explain.

34. The graph of $y = x^2$ is compressed vertically by a factor of $\frac{1}{4}$, reflected in the y-axis, translated 2 units left and translated 5 units downward.

- a) Write the equation of the transformed function.
- b) State its domain and range of the transformed function.

35. Find the exact value of the following trigonometric ratio. $\tan 315^\circ$

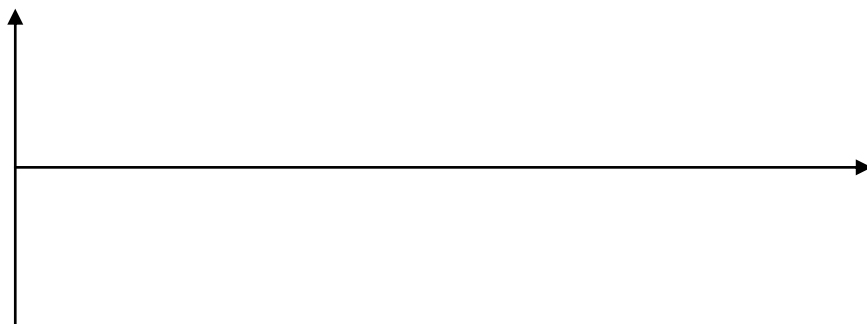
36. If $0^\circ \leq \theta \leq 360^\circ$, find the possible measures of $\angle \theta$ for the following ratio. $\sin \theta = -\frac{1}{\sqrt{2}}$

37. The boom of a crane can have its angle of inclination changed. The minimum angle is 30° and the maximum value is 45° . If the boom is 10 m long, find the vertical displacement of the end of the boom when the angle changes from a minimum to a maximum. Express your answer in **exact** and **approximate** form, to the nearest **tenth** of a metre.

38. a) Find t_n given the following terms from a geometric sequence:
 $t_5=80$ and $t_7=320$

b) Find the first three terms.

39. Sketch and label a graph of a periodic function with a period of 6 and an amplitude of 4.



40. Determine the amplitude, period, vertical translation, and phase shift (if any) for the function $y = 2 \cos(3x - 90^\circ) + 3$ with respect to $y = \cos x$.

Amplitude (a) = _____ Period = _____

Vert. Trans. = _____ Phase Shift = _____

41. Evaluate $\cos 175^\circ$ to **four** decimal places.

42. If the cosine of an angle is -0.4328, can the angle be acute? Explain.

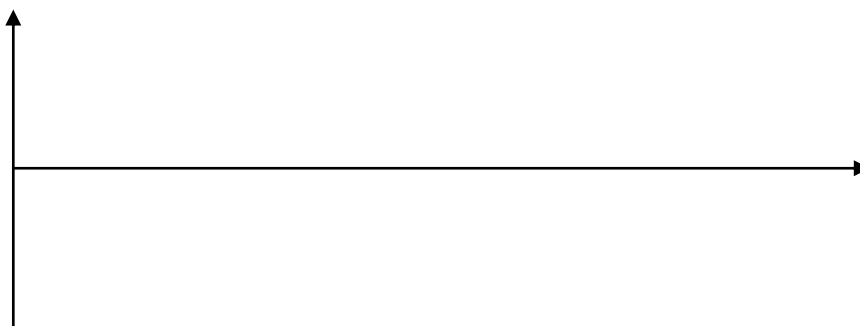
43. If the sine of an angle is 0.3781, can the angle be obtuse? Explain.

44. Write an equation for the function with the given characteristics:

Function	Amplitude	Period	Vert. Trans.	Horiz. Trans.
cosine	2.7	540°	2 units down	45° right

$y =$ _____

45. a) Sketch and label one cycle of the graph of $y = 2 \cos 2x$.



b) State the domain and range for one cycle of $y = 2 \cos 2x$.

46. a) What mathematical procedure must be performed on the following equation in order to more easily identify its characteristics?
$$y = 7 \cos(5x - 4) + 2$$
- b) Perform that procedure. Show your work.
- c) Describe the transformations that will occur to the graph of $y = \cos x$ in order to produce the graph given by the equation $y = 7 \cos(5x - 4) + 2$
47. Each graph shows part of the sine function of the form $y = a \sin k(x - d) + c$. Write the equation for each graph using the actual values of a , k , d , and c .

$y =$ _____

$y =$ _____

48. Prove that a) $\cos x = \frac{1}{\cos x} - \sin x \tan x$ b) $\csc x(\sin x - 1) = 1 - \csc x$

49. Oscar invests \$3200 he won for an essay contest. The investment pays 6.5% per annum, compounded monthly. How much will Oscar have after 18 months?
50. Starting in 6 months, Lily will deposit \$1000 into an account every March 1st and September 1st for 10 years. How much will she have at the time of the last payment if interest is 5.5% per annum, compounded semi-annually?
51. Josh has sold his business and plans to retire. He wants to deposit enough of the money from the sale of receive a payment of \$4000 a month for 20 years, starting in a month. He is considering an investment with an interest rate of 5.4% per annum compounded monthly. How much does he need to deposit now for this investment?

52. a) Find the formula for the n th term that determines this sequence: $-3.5, -1, 1.5, \dots$

b) Find t_{21} for this sequence

52. Find the number of terms in the sequence $4, 12, 36, \dots, 2916$.

53. Human scalp hair grows at a rate of about 0.25 cm/week.

a) If a person's hair begins as 14.5 cm long, how long will it be after

i) one week?

ii) seven weeks?

b) How many weeks will it take for the hair to grow from 14.5 cm to 19.5 cm in length?

54. A marching band has 8 musicians in the first row, 10 musicians in the second row, 12 musicians in the third row, and so on. If there are 12 rows, how many musicians are in the band?

55. The CN tower restaurant completes $\frac{5}{6}$ of a rotation every hour. If lunch goes from 13:15 to 14:35, through what angle did their table rotate during the meal? Express your answer in radian measure in **exact** form and in **approximate** form, to the nearest tenth.

56. Solve:

a) $2^{x+2} - 2^x = 48$

b) $3^{3x-1} = \frac{1}{81}$

57. A bacteria culture doubles every $\frac{1}{4}$ hour. At time $1\frac{1}{4}$ h an estimate of 40 000 is taken.

- a) What is the initial size of the culture?
- b) What is it after 2 h?
- c) What is it after 3 h?

Important: Review quizzes and unit tests. Ask for help early! This review, while a good start, is not necessarily complete. You are ultimately responsible for thoroughly reviewing all the material from this course.