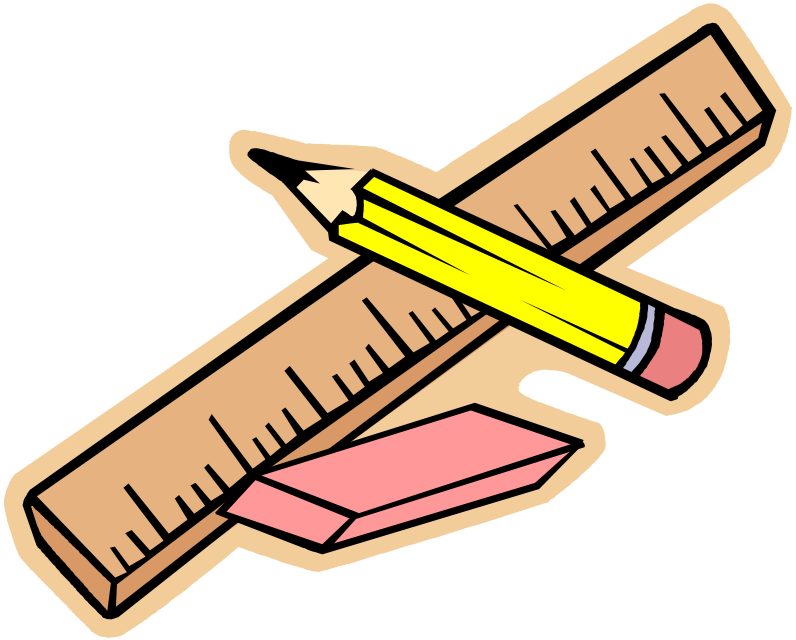
MCR 3UI

EXAM REVIEW



2 Hour Exam

Unit 1: Algebraic Tools for Operating with Functions: Rational Expressions

1. Simplify. State any restrictions on the variables.

a) $(4x^2-7x-7)-(8x^2-5x-9)$

b) $2(x-3)^2-(2x+1)(3x+2)$

c) $\dfrac{3x-3y}{5x-5y}$

d) $\dfrac{x^2-16}{x^2-x-12}$

e) $\dfrac{x^2+2x-3}{x^2+6x+8}\times\dfrac{x^2+2x-8}{x^2+x-6}$

f) $\dfrac{2x^2-x-1}{3x^2+x-2}\div\dfrac{2x^2-3x-2}{3x^2-11x+6}$

g) $\dfrac{x+2}{3}+\dfrac{2x-1}{4}-\dfrac{3x+1}{2}$

h) $\dfrac{4}{2x-3}-\dfrac{1}{3-2x}$

i) $\dfrac{2}{x^2+5x+4}-\dfrac{3}{x^2-3x-4}$

j) $\dfrac{x+1}{3x^2+4x+1}+\dfrac{2x-1}{3x^2-5x-2}$

k) $\dfrac{2x+2}{x^2-1}+\dfrac{x^2-1}{2x^2-x-1}\div\dfrac{9x+6}{12x+6}$

l) $\frac{2x+4}{4x}-\frac{7x+7}{3x}\times\frac{5x^2}{14x^2+14x}$

Unit 2: Radical Mathematics and Quadratic Functions

2. Simplify.

a) $\sqrt{50}$

b) $\sqrt{44}$

c) $2\sqrt{3}\times\sqrt{6}$

d) $\dfrac{\sqrt{72}}{\sqrt{6}}$

e) $5\sqrt{10}\times3\sqrt{2}$

f) $\left(2\sqrt{5}\right)^2$

g) $\dfrac{8-\sqrt{40}}{2}$

h) $\dfrac{15\sqrt{48}}{5\sqrt{3}}$

i) $\sqrt{48}-\sqrt{27}+\sqrt{12}$

j) $\sqrt{6}(3\sqrt{2}+2\sqrt{8})$

k) $(2-\sqrt{3})(1+3\sqrt{3})$

l) $\dfrac{2}{\sqrt{7}}$

m) $\dfrac{3}{\sqrt{3}-4}$

n) $\dfrac{5}{2\sqrt{6}+\sqrt{3}}$

NOTE: Simplify (l), (m), and (n) by rationalizing the denominator.

3. Solve by factoring.

a) $2x^2-7x=4$

b) $3x^2=6-7x$

4. Solve using the quadratic formula.

a) $x^2-5x=13$

b) $3x^2=-3x+7$

5. Complete the square and Partially Factor each of the following. State the maximum or minimum value of each function and the value of *x* when it occurs.

a) $y=x^2-7x+2$

b) $y=-4x^2-8x+5$

c) $y=-2x^2+5x+5$

d) $y=\frac{1}{2}x^2-4x+6$

6. Quadratic Story Questions.

A. The function $h(t)=-4t^2+20t+2$ gives the approximate height, *h* metres of a thrown football as a function of the time, *t* seconds since it was thrown. The ball hit the ground before a receiver could get near it.

a) How long was the ball in the air, to the nearest tenth of second?
b) For how many seconds was the height of the ball at least 17 m?
c) What is the maximum height of the ball?

B. The height of an object, h(t), in metres, can be modelled by the equation $h(t) = 15t - 4t^2$, where t is the time in seconds after the object is released.
Can the object ever reach a height of 10 m? Explain.

C. The profit function for a company is modelled by, $P(x) = -3x^2 + 7x + 9$, where *x* is the number of items produced, in thousands. Determine the break-even point(s).

7. Calculate the value of k such that $kx^2 - 3x + k = 0$ has: (a) one root. (b) two roots.

8. Does the linear function $g(x) = x + 2$ intersect the quadratic function $f(x) = 2x^2 - 2x - 3$? How can you tell? If it does intersect, determine the point(s) of intersection.

9. Determine the equation of the parabola with roots $3 + \sqrt{5}$ and $3 - \sqrt{5}$, and passing through the point (3, 10)

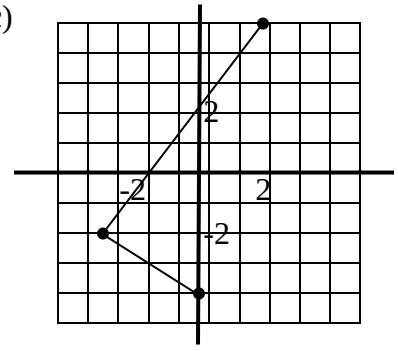
Unit 3: Transformations of Functions

10. For each of the following, state the domain, range and whether or not it is a function.

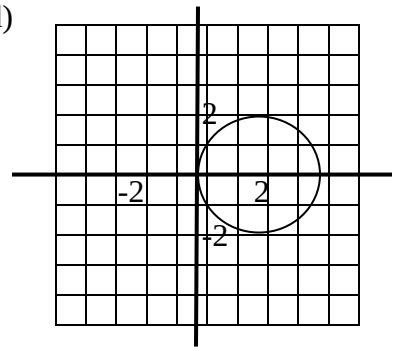
a) $\{ (2,4),\ (3,5),\ (7,9)\ (2,-5)\ ,(3,-7) \}$

b) $\{ (-1,6),\ (0,-6),\ (1,-6)\ (2,-6) \}$

c)



d)



11. If $f(x) = 3 - 2x^2$, find:

a) $f(5)$

b) $f\left(-\frac{1}{2}\right)$

12. Describe the transformations of the following functions from the graph of $f(x)$.

a) $y = f(x-2) - 3$

b) $y = -f(x+5) - 1$

c) $y = \frac{1}{3} f(-3x) + 5$

d) $y = -2f(2(x+3)) + 6$

13. Describe the transformations on $f(x) = x^2$ required to graph $y = -\frac{1}{4}\left[\frac{1}{2}(x-8)\right]^2$.

14. Find the inverse of each function. Is the inverse a function? Explain.

a) $y = 3x - 5$

b) $y = x^2 - 7$

c) $y = (x+2)^2$

d) $y = \sqrt{x-3}$

15. i) Use transformations to sketch the graphs of each of the following pairs of functions on the same set of axes. The first function is the Parent/Base Function.

a) $y = \sqrt{x}$ and $y = \sqrt{x} - 4$

b) $y = x^2$ and $y = -\frac{1}{2}(x+1)^2 - 3$

c) $y = 2^x$ and $y = -2^x$

d) $y = \frac{1}{x}$ and $y = \frac{3}{x+2}$

ii) State the domain and range of each function.

16. The graph of $y = x^2$ is stretched vertically by a factor of 2, translated 3 units to the left and translated 4 units upward. Write the equation of the transformed function and state its domain and range.

17. Given $f(x) = x^2 + 6x$

a) Write equations for $-f(x)$ and $f(-x)$.

b) Sketch the three graphs on the same set of axes.

c) Determine any points that are invariant for each reflection.

18. Copy and complete the chart below.

Relation	Rough Sketch	Domain	Range	Function? Yes or No
a) $y = 3x$				
b) $y = 2(x-1)^2 - 4$				
c) $y = -\sqrt{x} + 2$				
d) $y = \frac{1}{x}$				
e) $y = 3^x$				
f) $x^2 + y^2 = 25$				

Unit 4: Exponential Functions

19. Simplify. Express each answer with positive exponents.

a) $x^{-1} \cdot x^{-3} \cdot x^2$

b) $(x^{-1}y^2)^{-2}$

c) $5x^4 \cdot 3x^2$

d) $(6x^{-1}y^2)(-x^{-3}y^{-4})$

e) $\frac{3xy^3 \times 10x^4y^2}{15x^2y^6}$

f) $\left(\frac{4x^{-3}y^4}{8x^2y^{-2}}\right)^{-2}$

20. Use exponent laws to evaluate the following. NO DECIMALS!!

a) 5^{-2} b) 6^{0} c) $(-3)^{-4}$

d) $\dfrac{x^{0}+3^{2}}{2^{4}-y^{0}}$ e) $25^{\frac{1}{2}}$ f) $\left(\dfrac{1}{27}\right)^{\frac{1}{3}}$

g) $(-32)^{\frac{4}{5}}$ h) $\left(\dfrac{81}{16}\right)^{\frac{5}{4}}$ i) $\left(\dfrac{27}{125}\right)^{-\frac{2}{3}}$

21. Express using exponents. Simplify where necessary.

a) $\sqrt[3]{-x}$ b) $\sqrt{\sqrt[3]{x^{2}}}$ c) $\left(\sqrt{x^{3}}\right)\left(\sqrt{x}\right)$

22. An insect colony, with an initial population of 50, triples every day.

(a) Which function models this exponential growth:

A: $p(n)=50\times 2^{n}$ B: $p(n)=150\times 3n$ C: $p(n)=50\times 3^{n}$

(b) For the correct model, explain what each part of the equation means.

23. Shylo is very excited about her brand new car! Although she paid $20,000 for the car, its resale value will depreciate (decrease) by 30% of its current value every year. The equation relating the car's depreciated value, *v*, in dollars, to the time, *t*, in years since her purchase is $v(t) = 20000\,(0.7)^{t}$.

(a) Explain the significance of each part of this equation.

(b) How much will Shylo's car be worth in

(i) 1 year? (ii) 2 years?

(c) How long will it take for Shylo's car to depreciate to 10% of its original price?

24. (a) Is an exponential function either always increasing or always decreasing? Explain.

(b) Is it possible for an exponential function of the form $y = ab^{x}$ to have an x-intercept? If yes, give an example. If no, explain why not.

25. Match each transformation with the corresponding equation, using the function $y = 10^{x}$ as the base. Give reasons for your answers. Not all transformations will match an equation.

Transformation

(a) horizontal stretch by a factor of 3

(b) shift 3 units up

(c) shift 3 units left

(d) vertical compression by a factor of $\dfrac{1}{3}$

(e) vertical stretch by a factor of 3

(f) shift 3 units right

(g) reflect in the *x*-axis

Equation

A $y=10^{x}+3$

B $y=10^{x+3}$

C $y=-10^{x}$

D $y=10^{x}-3$

E $y=10^{3x}$

F $y=10^{-x}$

G $y=\left(\dfrac{1}{3}\right)10^{x}$

26. (a) Describe the transformations that must be applied to the graph of $y = 3^x$ to obtain the graph of : i) $y = 5(3)^{2x} - 1$ ii) $y = -\left(\frac{1}{3}\right)^{12-3x} + 2$.

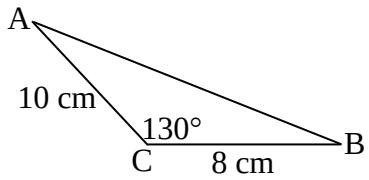
(b) Graph each function from part a).

(c) Identify the following properties of the transformed function.
(i) domain
(ii) range
(iii) equation of the asymptote
(iv) intercept(s), if they exist

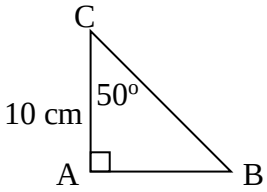
Unit 5: Trigonometry

27. Determine the value of c to one decimal place.

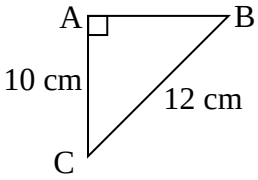
a)



b)

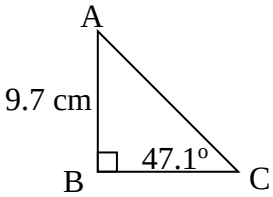


c)



28. Solve each triangle. Round each side length and angle to the nearest tenth.

a)



b) In ΔKLM, $\angle K = 90^\circ$, $m = 12.4\ cm$ and $l = 8.8\ cm$.

29. The Toronto Stock Exchange is housed in the Exchange Tower. From the top of the building, the angle of depression to a point on the ground 100 m from the foot of the building is 55.6°. Determine the height of the building, to the nearest metre.

30. The point (20, 21) is on the terminal arm of an angle θ in standard position. Find $\sin\theta$ and $\cos\theta$.

31. Find $\angle A$ to the nearest tenth of a degree, if $0^\circ \le A \le 180^\circ$.
a) $\sin A = 0.6157$ b) $\cos A = 0.2756$ c) $\cos A = -0.8988$

32. Solve each triangle. Round each side length and angle to the nearest tenth.
a) In ΔABC, $\angle A = 52.5^\circ$, $\angle B = 73.4^\circ$ and $b = 36.6\ cm$
b) In ΔRST, $r = 12.6\ m$, $s = 11.5\ m$ and $t = 13.2\ m$
c) In ΔEFG, $\angle F = 67.8^\circ$, $f = 12.6\ m$ and $e = 9.8\ m$

33. An isosceles triangle has two 5.5 cm sides and two 32.4° angles. Find:
a) the perimeter of the triangle to the nearest tenth of a centimetre.
b) the area of the triangle, to the nearest tenth of a square centimetre.

34. Airport X is 150 *km* east of airport Y. An aircraft is 240 km from airport Y and 23° north of due west from airport Y. How far is the aircraft from airport X to the nearest kilometer?

35. Two ships left Port Hope on Lake Ontario at the same time. One travelled at 12 km/h on a course of 235°. The other travelled at 15 km/h on a course of 105°. How far apart were the ships after four hours to the nearest kilometer?

36. Determine the number of triangles that could be drawn with the given measures. Then, find the measures of the other angles and the other side in each possible triangle.
a) In ΔGHI, $\angle G = 20^\circ$, $g = 2\ cm$ and $h = 5\ cm$
b) In ΔXYZ, $\angle X = 43^\circ$, $x = 2\ m$ and $y = 4\ m$
c) In ΔABC, $\angle B = 104.5^\circ$, $c = 1.4\ m$ and $b = 3.9\ m$

Unit 6: Trigonometric Functions

37. The coordinates of a point P on the terminal arm of an angle, θ, in standard position, where $0 \le \theta \le 360^o$. Determine the exact values of $\sin\theta$, $\cos\theta$ and $\tan\theta$.
a) P(4, 5) b) P(7, -4)

38. Find the exact value of each trigonometric ratio:
a) $\tan 225^\circ$ b) $\cos 150^o$

39. If $0^\circ \le \theta \le 360^\circ$, find the possible measures of $\angle A$:
a) $\cos A = \dfrac{1}{\sqrt{2}}$ b) $\tan A = -\sqrt{3}$

40. Sketch one cycle of the graph of each of the following. State the domain, range, amplitude, period, vertical translation (when necessary!) and phase shift (when necessary!).
a) $y = \sin x$ b) $y = -2\sin 2x + 2$ c) $y = \dfrac{1}{2}\sin\left(x + 45^o\right)$
d) $y = \cos x$ e) $y = 3\cos\dfrac{1}{3}x$ f) $y = 2\cos\dfrac{1}{2}\left(x - 180^o\right) + 1$

41. Prove each identity.
a) $\dfrac{1-\sin^2 x}{\cos x} = \cos x$ b) $1 + \tan^2 x = \dfrac{1}{\cos^2 x}$ c) $\dfrac{1}{\sin x} - \sin x = \dfrac{\cos x}{\tan x}$
d) $\dfrac{1-\tan^2 x}{1+\tan^2 x} = \cos^2 x - \sin^2 x$ e) $(1-\cos^2 x)(1+\tan^2 x) = \tan^2 x$ f) $(\sin x - \cos x)^2 = 1 - 2\sin x\cos x$
g) $(1+\cot^2 x)\tan^2 x = \sec^2 x$ h) $\sin x \sec x = \tan x$ i) $\tan x(1+\cot x) = 1 + \tan x$

42. Solve each equation for $0 \le x \le 360^o$.

a) $\sin x = \dfrac{-\sqrt{3}}{2}$ b) $\sqrt{2}\cos x + 1 = 0$ c) $2\sin x - 1 = 0$

d) $\tan x = \sqrt{3}$ e) $(\sqrt{2}\cos x + 1)(\sin x - 1) = 0$ f) $2\cos^2 x + 3\cos x = -1$

g) $\cos x + 1 = 2\sin^2 x$ h) $\cos^2 x - 1 = \sin^2 x$ i) $15\sin^2 x + \sin x = 2$

Unit 7: Sequences and Series

$t_n = a + (n-1)d$	$t_n = ar^{n-1}$	$S_n = \dfrac{n}{2}\left[2a + (n-1)d\right]$
$S_n = \dfrac{n}{2}\left[a + t_n\right]$	$S_n = \dfrac{a(r^n - 1)}{r - 1}$	

43. Find the formula for the *n*th term and find the indicated term for each arithmetic sequence.

a) 3, 5, 7, ... ; t_{30} b) -4, 3, 10, ... ; t_{18}

44. Find the number of terms in each arithmetic sequence.

a) 4, 9, 14, ... , 169 b) 19, 11, 3, ... ,–229

45. The Women's World Cup of Soccer tournament was first held in 1991. The next two tournaments were held in 1995 and 1999.

a) Write a formula for finding the year in which the nth tournament will be held.
b) Predict the year of the 35th tournament.

46. Find the formula for the *n*th term and find the indicated term for each geometric sequence.

a) 27, 9, 3, ... ; t_6 b) 1, –3, 9, ... ; t_7

47. Find a, r, *and* t_n for each geometric sequence.

a) $t_4 = 24$ *and* $t_6 = 96$ b) $t_2 = -6$ *and* $t_5 = -162$

48. Use the recursion formula to write the first 5 terms of each sequence.

a) $t_1 = 3;\ t_2 = 3;\ t_n = t_{n-1} + t_{n-2}$ b) $f(1) = 8;\ f(n) = 0.5 f(n-1)$

49. Identify whether the series is Arithmetic or Geometric. Then, find *n*.

a) $1 + 2 + 4 + \ldots + 1024$ b) $-5 - 2 + 1 + 4 \ldots + 133$ c) $16384 + 4096 + \ldots + 1$

50. Find the indicated sum for each arithmetic series.

a) S_{25} for $-20-18-16$ b) $1+\frac{5}{4}+\frac{3}{2}+\ldots+20$

51. The side lengths in a quadrilateral from an arithmetic sequence. The perimeter is 38 cm and the shortest side measures 5 cm. What are the other side lengths?

52. Find the indicated sum for each geometric series.

a) S_{12} for $4-8+16-32+\ldots$ b) $3645-1215+405-\ldots+5$

53. A ball is kicked from the ground 6.4 m into the air. The ball falls, rebounds to 60% of its previous height and falls again. If the ball continues to rebound and fall in this manner, find the total distance the ball travels until it hits the ground for the fifth time (assume the ball bounces vertically with no curvature in its path).

Unit 8: Compound Interest and Annuities

$I = \Pr t$	$A = P(1+i)^n$	$PV = A(1+i)^{-n}$
$A = \frac{R[(1+i)^n - 1]}{i}$	$P = \frac{R[1-(1+i)^{-n}]}{i}$	

54. Find the amount of each investment:

a) $2,200 for 5 years at 12% per annum, compounded monthly.

b) $12,600 for 4 years at 6.75% per annum, compounded quarterly.

55. Jean Paul is saving for a car. He puts $4,500 in a Guaranteed Investment Certificate paying 5.25% per annum, compounded quarterly. How much money will he have available to buy a car 3 years from now?

56. What is the present value for each amount?

a) $9,000 in 5 years, invested at 5.6% per annum, compounded semi-annually

b) $250,000 in a year, invested at 8.75% per annum, compounded quarterly.

57. Marianna deposited $200 into her bank account at the end of each month for 8 months.

a) The account pays 2.9% per annum, compounded monthly. How much is in her account at the end of the 8 months.

b) If the amount deposited each month were doubled, how much would be in the account at the end of the eight months.

58. Faris needs $5,000 for university in 3 years. His parents plan to invest some money in an account paying interest at a rate of 7.1% per annum, compounded quarterly. How much should they invest now to have $5,000 in 3 years?

59. a) Michael wants to make an investment so that he would receive $4,000 every 6 months for 5 years, with the first payment due in 6 months. How much money should he invest now at 7% per annum, compounded semi-annually?

b) How much interest would be earned over the life of the investment?

60. To provide an annual scholarship for 25 years, a donation of $50,000 is invested in an account for a scholarship that will start a year after the investments is made. If the money is invested at 5.5% per annum, compounded annually, how much is each scholarship?

61. Brooke won $100,000 in a lottery. The prize will be paid in yearly installments of $10,000 each year for 10 years. What is the present value of her winnings, if current interest rates are 6.4% compounded annually?

62. Mrs. Behnke bought a new car. She financed $13,500 at 3.9% /a compounded monthly and chose to make monthly payments for 4 years.
a) What amount does Mrs. Behnke pay per month?
b) The dealership told Mrs. Behnke that her payments would be $321.89 per month for 48 months. If Mrs. Behnke didn't correct them, how much extra would she pay?

ANSWERS

UNIT 1

1a $-4x^2-2x+2$ 1b $-4x^2-19x+16$ 1c $\frac{3}{5},\ x \neq y$ 1d $\frac{x+4}{x+3},\ x \neq -3,\ 4$ 1e $\frac{x-1}{x+2},\ x \neq -4,\ -3,\ -2,\ 2$ 1f $\frac{(x-1)(x-3)}{(x+1)(x-2)},\ x \neq -1,\ -\frac{1}{2},\ \frac{2}{3},\ 2,\ 3$

1g $\frac{-8x-1}{12},$ 1h $\frac{5}{2x-3},\ x \neq \frac{3}{2}$ 1i $\frac{-x-20}{(x+1)(x+4)(x-4)},\ x \neq -4,\ -1,\ 4$ 1j $\frac{3x-3}{(3x+1)(x-2)},\ x \neq -1,\ -\frac{1}{3},\ 2$ 1k $\frac{2x^2+6x+2}{(x-1)(3x+2)},\ x \neq \pm 1, -\frac{1}{2}, -\frac{2}{3}$ 1l $\frac{-x+3}{3x},\ x \neq -1, 0$

UNIT 2

2a $5\sqrt{2}$ 2b $2\sqrt{11}$ 2c $6\sqrt{2}$ 2d $2\sqrt{3}$ 2e $30\sqrt{5}$ 2f 20

2g $4-\sqrt{10}$ 2h 12 2i $3\sqrt{3}$ 2j $14\sqrt{3}$ 2k $5\sqrt{3}-7$ 2l $\frac{2\sqrt{7}}{7}$

2m $-\frac{3(\sqrt{3}+4)}{13}$ 2n $\frac{5(2\sqrt{6}-\sqrt{3})}{21}$ 3a $x=-\frac{1}{2},\ 4$ 3b $x=-3,\ \frac{2}{3}$ 4a $x=\frac{5\pm\sqrt{77}}{2}$ 4b $x=\frac{-3\pm\sqrt{93}}{6}$

5a $\min=\frac{-41}{4},\ x=\frac{7}{2}$ 5b $\max=9,\ x=-1$ 5c $\max=\frac{65}{8},\ x=\frac{5}{4}$ 5d $\min=-2,\ x=4$ 6.A a) 5.1 *s* b) 3.2 *s* c) 27 *m* 6B Yes, Discriminant =65

6C 3255 items 7a $k \in \left\{\pm\frac{3}{2}\right\}$ 7b $\left\{k \in \mathbb{R}, -\frac{3}{2} < k < \frac{3}{2}\right\}$ 8 D=49 so 2 points of intersection $(-1,1), \left(\frac{5}{2}, \frac{9}{2}\right)$ 9 $y=-2x^2+12x-8$

UNIT 3

10a D: {2 ,3, 7}
R: {–7, –5, 4, 5, 9}
Not a function

10b D: {–1 ,0, 1, 2}
R: {–6, 6}
Function

10c D: $\{-3 \le x \le 2,\ x \in R\}$
R: $\{-4 \le y \le 5\ \ y \in R\}$
Not a function

10d D: $\{0 \le x \le 4,\ x \in R\}$
R: $\{-2 \le y \le 2\ \ y \in R\}$
Not a function

11a -47

11b $\frac{5}{2}$

12a Translated 2 units right
Translated 3 units down

12b Reflected in x-axis
Translated 5 units left
Translated 1 unit down

12c Reflected in y-axis
Vertical compression factor 1/3
Horizontal compression factor 1/3
Translated 5 units up

12d Reflected in x-axis
Vertical stretch by a factor of 2
Horizontal compression by 2
Translated 3 units left
Translated 6 units up

13 Reflected in x-axis
Vertical compression by factor ¼
Horizontal stretch by factor 2
Translated 8 units right

14a $f^{-1}(x)=\frac{x}{3}+\frac{5}{3}$
Function

14b $f^{-1}(x) = \pm\sqrt{x+7}$
Not a function

14c $f^{-1}(x) = \pm\sqrt{x} - 2$
Not a function

14d $f^{-1}(x) = x^2 + 3$
Function

15a (i) Translated 4 units down
(ii) $D: \{x | x \in \mathbb{R}, x \geq 0\}$ $R: \{y | y \in \mathbb{R}, y \geq 0\}$
$D: \{x | x \in \mathbb{R}, x \geq 0\}$ $R: \{y | y \in \mathbb{R}, y \geq -4\}$

15b (i) Reflected in x-axis
Vertical compression by factor of 1/2
Translated 1 unit left, 3 units down
(ii) $D: \{x | x \in \mathbb{R}\}$ $R: \{y | y \in \mathbb{R}, y \geq 0\}$
$D: \{x | x \in \mathbb{R}\}$ $R: \{y | y \in \mathbb{R}, y \leq -3\}$

15c (i) Reflected in x-axis
(ii) $D: \{x | x \in \mathbb{R}\}$ $R: \{y | y \in \mathbb{R}, y > 0\}$
$D: \{x | x \in \mathbb{R}\}$ $R: \{y | y \in \mathbb{R}, y < 0\}$

15d (i) Vertical stretch by factor of 3
Translated 2 units left
(ii) $D: \{x | x \in \mathbb{R}, x \neq 0\}$ $R: \{y | y \in \mathbb{R}, y \neq 0\}$
$D: \{x | x \in \mathbb{R}, x \neq -2\}$ $R: \{y | y \in \mathbb{R}, y \neq 0\}$

16 $f(x) = 2(x+3)^2 + 4$
D: $\{x \in R\}$
R: $\{y \geq 4,\ y \in R\}$

17a $-f(x) = -x^2 - 6x$
$f(-x) = x^2 - 6x$

17c $-f(x)$: $(0,\ 0),\ (-6,\ 0)$
$f(-x)$: $(0,\ 0)$

18a D: $\{x \in R\}$
R: $\{y \in R\}$
Function

18b D: $\{x \in R\}$
R: $\{y \geq -4,\ y \in R\}$
Function

18c D: $\{x \geq 0,\ x \in R\}$
R: $\{y \leq 2,\ y \in R\}$
Function

18d D: $\{x \neq 0,\ x \in R\}$
R: $\{y \neq 0,\ y \in R\}$
Function

18e D: $\{x \in R\}$
R: $\{y > 0,\ y \in R\}$
Function

18f D: $\{-5 \leq x \leq 5,\ x \in R\}$
R: $\{-5 \leq y \leq 5\ y \in R\}$
Not a function

UNIT 4

19a $\frac{1}{x^2}$

19b $\frac{x^2}{y^4}$

19c $15x^6$

19d $\frac{-6}{x^4 y^2}$

19e $\frac{2x^3}{y}$

19f $\frac{4x^{10}}{y^{12}}$

20a $\frac{1}{25}$

20b 1

20c $\frac{1}{81}$

20d $\frac{2}{3}$

20e 5

20f $\frac{1}{3}$

20g 16

20h $\frac{243}{32}$

20i $\frac{25}{9}$

21a $(-x)^{\frac{1}{3}}$

21b $x^{\frac{1}{3}}$

21c x^2

22a C

22b $p(n) = 50 \times (3)^n$
50: Initial population
3: rate of increase
n: number of days

23a $v(t) = 20000 \times (0.7)^t$
20000: Initial value of the car
0.7: percent of value carried to the next year
t: number of years

23bi \$14 000

23bii \$ 9800

23c 6.5 years

24a Yes

24b No

25a $y = 10^{\frac{1}{3}x}$: not listed

25b A

25c B

25d G

25e $y = 3(10^x)$: not listed

25f $y = 10^{x-3}$: not listed

25g C

26ai Vertical stretch of factor 5
Horizontal compression of factor 1/2
Shift down 1 unit

26ci Domain: $\{x \in R\}$
Range: $\{y > -1, y \in R\}$
Asymptote: $y = -1$
x-intercept: $x \cong 0.73$

26aii Reflection over x-axis
Horizontal compression of factor 1/3
Shift 4 units right
Shift 2 units up

26cii Domain: $\{x \in R\}$
Range: $\{y < 2, y \in R\}$
Asymptote: $y = 2$
x-intercept: $x \cong 4.21$

UNIT 5

27a 16.3 cm

27b 11.9 cm

27c 6.6 cm

28a $A = 42.9^\circ$
$a = 9.0\ cm$
$b = 13.2\ cm$

28b $L = 35.4^\circ$
$M = 54.6^\circ$
$k = 15.2\ cm$

29 146 m

30	$\sin\theta = \frac{21}{29}$ $\cos\theta = \frac{20}{29}$	31a	$A = 38.0^\circ$ *or* $A = 142.0^\circ$	31b	$A = 74.0^\circ$	31c	$A = 154.0^\circ$	32a	$C = 54.1^\circ$ $a = 30.3\ cm$ $c = 30.9\ cm$	32b	$S = 52.9^\circ$ $R = 60.9^\circ$ $T = 66.2^\circ$
32c	$G = 66.1^\circ$ $E = 46.1^\circ$ $g = 12.4\ m$	33a	20.3 *cm*	33b	$13.5\ cm^2$	34	383 *km*	35	98 *km*		
36a	2 Triangles $H = 58.8^\circ,$ $I = 101.2^\circ,$ $i = 5.7cm$ *or* $H = 121.2^\circ,$ $I = 38.8^\circ,$ $i = 3.7cm$	36b	0 Triangles	36c	1 Triangle, $C = 20.3^\circ,$ $A = 55.2^\circ,$ $a = 3.3m$						

UNIT 6

37a	$\sin\theta = \frac{5}{\sqrt{41}},\ \cos\theta = \frac{4}{\sqrt{41}}, \tan\theta = \frac{5}{4}$	37b	$\sin\theta = \frac{-4}{\sqrt{65}},\ \cos\theta = \frac{7}{\sqrt{65}}, \tan\theta = -\frac{4}{7}$	38a	1						
38b	$-\frac{\sqrt{3}}{2}$	39a	$A = 45^\circ,\ 315^\circ$	39b	$A = 120^\circ,\ 300^\circ$						
40a	$D:\ \{0^\circ \le x \le 360^\circ,\ x \in R\}$ $R:\ \{-1 \le y \le 1\ \ y \in R\}$ *Amplitude* $= 1$ *Period* $= 360^\circ$ *Phase Shift* $=$ *none*	40b	$D:\ \{0^\circ \le x \le 180^\circ,\ x \in R\}$ $R:\ \{0 \le y \le 4\ \ y \in R\}$ *Amplitude* $= 2$ *Period* $= 180^\circ$ *Phase Shift* $=$ *none* *Up* 2 *units*	40c	$D:\ \{-45^\circ \le x \le 315^\circ,\ x \in R\}$ $R:\ \{-\frac{1}{2} \le y \le \frac{1}{2}\ \ y \in R\}$ *Amplitude* $= \frac{1}{2}$ *Period* $= 360^\circ$ *Phase Shift* $=$ *left* 45°					
40d	$D:\ \{0^\circ \le x \le 360^\circ,\ x \in R\}$ $R:\ \{-1 \le y \le 1\ \ y \in R\}$ *Amplitude* $= 1$ *Period* $= 360^\circ$ *Phase Shift* $=$ *none*	40e	$D:\ \{0^\circ \le x \le 1080^\circ,\ x \in R\}$ $R:\ \{-3 \le y \le 3\ \ y \in R\}$ *Amplitude* $= 3$ *Period* $= 1080^\circ$ *Phase Shift* $=$ *none*	40f	$D:\ \{180^\circ \le x \le 900^\circ,\ x \in R\}$ $R:\ \{-1 \le y \le 3\ \ y \in R\}$ *Amplitude* $= 2$ *Period* $= 720^\circ$ *Phase Shift* $=$ *right* 180° *Up* 1 *unit*					
42a	$x = 240^\circ,\ 300^\circ$	42b	$x = 135^\circ,\ 225^\circ$	42c	$x = 30^\circ,\ 150^\circ$						
42d	$x = 60^\circ,\ 240^\circ$	42e	$x = 90^\circ,\ 135,^\circ\ 225^\circ$	42f	$x = 120^\circ,\ 180,^\circ\ 240^\circ$						
42g	$x = 60^\circ,\ 180,^\circ\ 300^\circ$	42h	$x = 0^\circ, 180^\circ, 360^\circ$	42i	$x = 19.5^\circ,\ 160.5,^\circ\ 203.6^\circ,\ 336.4°$						

UNIT 7

43a	$t_n = 2n+1$ $t_{30} = 61$	43b	$t_n = 7n-11$ $t_{18} = 115$	44a	34	44b	32	45a	$t_n = 4n + 1987$	45b	2127
46a	$t_n = 27(3)^{1-n}$ $t_6 = \frac{1}{9}$	46b	$t_n = (-3)^{n-1}$ $t_7 = 729$	47a	$a = 3,\ r = 2\ , t_n = 3(2)^{n-1}$, *or* $a = -3,\ r = -2, t_n = -3(-2)^{n-1}$	47b	$a = -2,\ r = 3,$ $t_n = -2(3)^{n-1}$	48a	3, 3, 6, 9, 15	48b	8, 4, 2, 1, 0.5
49a	Geometric $n = 11$	49b	Arithmetic $n = 47$	49c	Geometric $n = 8$	50a	100	50b	$\frac{1617}{2}$	51	5, 8, 11, 14 cm
52a	-5460	52b	2735	53	29.5 *m*						

UNIT 8

54a	$3,996.73	54b	$16,468,41	55.	$5,262.22	56a	$6,828.28	56b	$229,270.89	57a	1613.60
57b	$3,227.20	58	$4,048.34	59a	$33,266.42	59b	$6733.58	60	$3,727.47	61	$72,225.92
62a	$304.21	62b	$848.64								