Date:___________ Name: __________________________

Review for FINALS

FINAL CULMINATING date_______________ FINAL EXAM date_______________

Success Criteria

- ☐ Ensure your Journals are complete and corrected. These you may use on the CULMINATING (but not on the EXAM)
- ☐ Complete the given Review booklet. Check your answers online.

FORMULAS GIVEN ON EXAM:

FORMULAS:

$A=P+Prt$, $I=Prt$

$A=P(1+i)^n$, $i=\frac{r}{C}$, $n=Ct$

$FV=\frac{R\left[(1+i)^n-1\right]}{i}$

$PV=\frac{R\left[1-(1+i)^{-n}\right]}{i}$

$t_n=a+(n-1)d$

$S_n=\frac{n}{2}\left[t_1+t_n\right]$

$t_n=ar^{n-1}$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$

$c^2=a^2+b^2-2ab\cos C$

$\cos C=\frac{a^2+b^2-c^2}{2ab}$

$S_n=\frac{t_{n+1}-t_1}{r-1}$

$S_n=\frac{n}{2}\left[2a+(n-1)d\right]$

$S_n=\frac{a(r^n-1)}{r-1}$

general function equations

$y=a(x-h)^2+c$ $\quad y=ax^2+bx+c$ $\quad y=a(x-r)(x-t)$

$y=mx+b$ $\quad y=ab^{\frac{x}{p}}$ $\quad y=ab^x+c$

$y=af[k(x-d)]+c$ for other functions $y=x^3, y=|x|, y=\sqrt{x}, etc$

Trig identities

Quotient Identities

$\tan\theta=\frac{\sin\theta}{\cos\theta}$

$\cot\theta=\frac{\cos\theta}{\sin\theta}$

Pythagorean Identities

$\sin^2\theta+\cos^2\theta=1$

$\tan^2\theta+1=\sec^2\theta$

$1+\cot^2\theta=\csc^2\theta$

Reciprocal Identities

$\csc\theta=\frac{1}{\sin\theta}$

$\sec\theta=\frac{1}{\cos\theta}$

$\cot\theta=\frac{1}{\tan\theta}$

On Culminating:
CAN use Journals
5 word problems

- Quadratics
- Exponentials
- Sinusoidals
- Trigonometry
- Finance

On Exam:
CAN NOT use Journals
But formula page is provided
Total 9 pages & 16 questions (some with a,b,c…)

Transformation of Functions (CH1) and Simplifying Rationals (CH2)

1. State the transformations, the domain and range and graph each of the following:

a. $f(x) = 2\sqrt{x} + 3$

b. $f(x) = \sqrt{-(x-2)}$

c. $f(x) = \sqrt{x-5}$

d. $y = \sqrt{-x-6}$

e. $f(x) = -7\sqrt{5(x+9)} + 12$

f. $y = |-x+4|$

g. $y = -2(x+4)^2 - 3$

h. $f(x) = \dfrac{2}{x-4} + 5$

i. $f(x) = \dfrac{1}{3x-6}$

2. Which relation is a function?

a. {(–4, –2), (–2, 3), (0, –2), (-4, 4)}

b. {(1, 1), (3, 2), (1, –3), (0, 2)}

c. {(–7, –7), (–2, 5), (–7, 6), (–2, –5)}

d. {(–4, –7), (–8, 5), (4, –2), (–9, 0)}

3. Which relation is a function?

a. $2x^2 - 5y^2 = -24$

b. $y = 2x^2 - 3x + 7$

c. $\dfrac{x^2}{4} - \dfrac{y^2}{9} = 1$

d. $y^2 = -x + 3y$

4. For each of the following find $f(2)$, $f(-3)$, $f(3) - f(5)$ and f^{-1}

a. $f(x) = 7 - 9x$ b. $f(x) = -4x^2 + 7$ c. $f(x) = 3x - 6$

5. Find the inverse of each of the following.

a. {(–10, 5), (–7, 9), (0, 6), (8, –12)} b. $f(x) = \sqrt{x-5}$ c. $f(x) = \dfrac{2}{x-4} + 5$

6. For $g(x) = 2\sqrt{x-5} + 3$, determine

a. $g(-6)$ b. $g^{-1}(x)$ c. $g^{-1}(-3)$ c. graph the function and it's inverse

7. Complete the table for the given transformations.

$f(x)$	$f(4x)$	$2f(4x)$	$-2f(4x)$	$-2f(4(x+3))+8$
(0, 0)				
(1, 1)				
(2, 3)				
(-3, -6)				

8. Suppose you make the changes below to the graph of the functions y = f(x). Write the equation of the image function.

a. Expand horizontally by a factor of 3, then reflect in the x-axis

b. Compress vertically by a factor of 4, then reflect about the y-axis.

c. Translate 3 units right and 5 units up.

9. Ms. Jackson has 40 m of fencing to make a rectangular pen for her rabbits. The wall of her house will serve as one side of the pen, so she will use fencing for only three sides of the rectangle. Express the area of the rabbit pen as a function of its width and then determine the domain and range of the area function.

10. Explain each of the transformations.

a. y = f(-2x)　　b. y = f(-x + 5)　　c. y = -3f(x) -4

11. You are given the function, $g(x) = x^2 + 5x + 6$

a) Graph the function.
b) State the domain and range of g(x)
c) Determine $g^{-1}(x)$, algebraically.
d) Graph $g^{-1}(x)$ on the same set of axes.
e) State the domain and range of $g^{-1}(x)$
f) Determine $g^{-1}(-6)$
g) Is $g^{-1}(x)$ a function?

12. Simplify each of the following equations, where possible state restrictions.

a. $2x(x+y)-3x(2x-3y)$

b. $(2x-3)^3$

c. $\frac{3}{4x-2}+\frac{5}{6x-3}$

d. $\frac{2a^2+12a}{a-5}\times\frac{a^2-4a-5}{a+6}$

e. $(6n^2-3n+9)-(n^2+3n-5)$

f. $(11v^2-6vw-3w^2)-(-7v^2+vw+13w^2)$

.

g. $\left(\frac{5}{6}g-\frac{7}{8}h\right)+\left(\frac{4}{9}g+\frac{7}{12}h-5\right)$.

h. $(2x-7)(-4x+5)$

i. $\frac{8g^3}{36g^4}$

j. $\frac{3x^2+6x}{2x+4}$

k. $\frac{d^2+10d+25}{5d^2-25d}$

l. $f(x)=\frac{x^2-5x-24}{x^2-7x-30}$

m. $\frac{3x}{14x^2}\times\frac{7x^2}{15x}$

n. $\frac{p-2}{3p+3}\times\frac{9p+9}{p+2}$

o. $\frac{4x-5}{6}\div\frac{8x-10}{12}$

p. $\frac{2x^2+7x+3}{x-4}\div\frac{x^2+8x+15}{x^2-16}$

q. $\frac{p}{p-1}+\frac{3}{p+1}$

r. $\frac{m}{3m^2-9m+6}-\frac{2m+1}{3m^2+3m-6}$

13. A rectangle has length (3*x* + 5) cm and width (2*x* – 1) cm. What is the area of the rectangle?

14. Factor

a. $x^2+13x-48$

b. $g^3+5g^2+2g+10$

c. $6x^2+36x+54$

d. $x^2-8x+16-9y^2$

e. $9x^2-16$

f. $n^3+3n^2-4n-12$

g. $2q^2+24q+72$

15. The area of a rectangle is represented by the function $A(x)=x^3+9x^2+x+9$. What is the perimeter of the rectangle?

Quadratics (CH3) and Exponential (CH4)

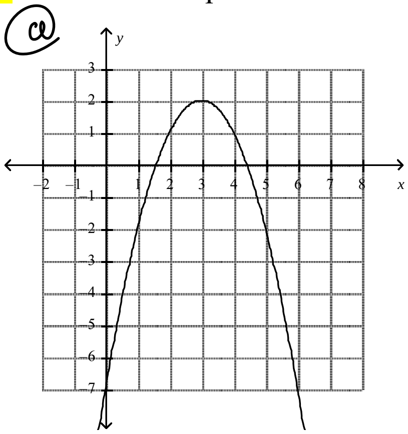
1. Given the equation of a quadratic function in standard form, $f(x) = -2x^2 - 4x + 16$, state

a. the zero(s) b. the vertex c. whether parabola has a maximum or minimum

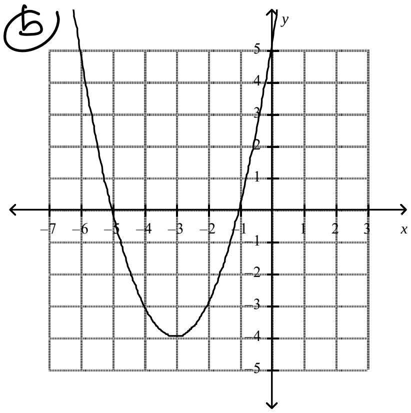
d. graph the function

2. What is the equation of the function for the graphs shown? Draw the inverses.

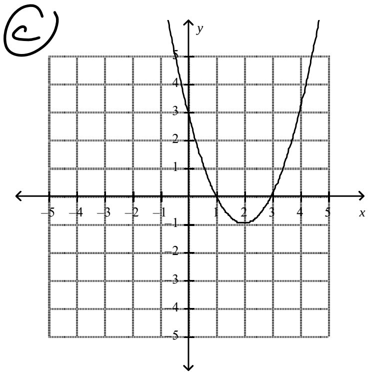
a



b



c



3. The set of ordered pairs {(–1, 0), (2, 0), (5, -54), (8, -162)} defines a parabola. What is the equation that defines the parabola?

4. For each of the following find the domain and range, the value of the discriminant, the number of roots, the value of the roots.

a. $f(x) = -(x+4)^2 - 7$

b. $x^2 - 3x - 28 = 0$

c. $f(x) = 8x^2 + 13x + 7$

d. $g(x) = x^2 - 3x + 4$

5. Find k for each of the following

a) ensure the system has two solutions

$$\begin{cases} x + y = -1 \\ x^2 + y^2 = k \end{cases}$$

b) ensure the system has one solution

$$\begin{cases} (x+2)^2 + (y-2)^2 = 1 \\ y = -(x+2)^2 + k \end{cases}$$

c) ensure the system has no solutions

$$\begin{cases} x + y = 1 \\ y = x^2 + k \end{cases}$$

6. Simplify each of the following.

a) $5\sqrt{48}$

b. $-\sqrt{42} \times 2\sqrt{3}$

c. $(7+\sqrt{8})(-2-\sqrt{18})$

d. $\dfrac{-4}{\sqrt{28}}$

e. $\dfrac{2\sqrt{30} - \sqrt{20}}{4\sqrt{5}}$

f. $\dfrac{\sqrt{21} + \sqrt{2}}{\sqrt{8} - 2\sqrt{3}}$

g. $\sqrt{51}$

h. $\sqrt{8} \times \sqrt{32}$

i. $\sqrt{3} + \sqrt{8} + \sqrt{75} + \sqrt{98}$

j. $\dfrac{2\sqrt{3}}{\sqrt{8}}$

k. $\sqrt{3}\left(\sqrt{6} + \sqrt{5}\right)$

7. The height, h, in metres of a baseball after it is hit with a bat is described by $h(t) = 1 + 17t - 5t^2$, where t is the time in seconds after the ball is struck.
a. What is the maximum height of the ball? Find the exact value.
b. What time does it reach the maximum height?
c. If the ball is caught 1.5 metres above the ground, **exactly** how long will it have been in the air?
d. If the ball is caught 1.5 metres above the ground, **approximately** how long will it have been in the air?

8. A firework was launched from the top of a 40 m building and it reaches a maximum height of 60 m in 4 seconds. a) Determine the equation that represents the height of the rocket over time.
b) When does the firework reach the ground?
c) What is the height of the rocket when it is in the air for 3 seconds?

9. A bicycle maker sold 300 bicycles last year at a profit of $300 each. The maker wants to increase the profit margin this year, but predicts that each $20 increase in profit will reduce the number of bicycles sold by 10. How many $20 increases in profit can the maker add in and expect to make a total profit of at least $100 000? Use the results to find how many increases will give you a maximum profit?

10. Determine the point(s) of intersection of the functions
   a. $f(x) = 3x^2 - 28x + 75$ and $g(x) = -x + 21$
   b. $f(x) = 2x^2 - 3x + 4$ and $g(x) = -4x + 7$

11. For the function, $f(x) = 2(x-4)^2 - 5$ complete the following:
a. Determine its inverse
b. Graph the function and its inverse.
c. State the domain and range of the function.
d. State the domain and range of the inverse
e. State whether the inverse is a function

12. Write each as a positive power, then evaluate.
a. $(2)^4(2)^{-5}$
b. $\left(\frac{3}{2}\right)^{-3}$
c. $8^{-\frac{1}{3}}$
d. $\left(\sqrt[4]{16}\right)^{-2}$
e. $\left(\frac{1}{4}\right)^{-\frac{3}{2}}\left(\frac{1}{4}\right)^{\frac{7}{2}}$
f. $(-27)^{-\frac{1}{3}}(27)^{\frac{1}{3}}$

13. Given the base $f(x) = 9^x$, what is the new equation given the following transformations.
a. A reflection in the y-axis and translation of 2 down
b. Vertical stretch by 2 and horizontal compression by 3
c. A reflection in the x-axis and translation of 5 to the right

14. For the following equations, simplify the equation into $y = ab^x + c$ form, find the equation of the asymptote for the function, state the domain and range and graph the function;
a. $f(x) = 2^{-x-4} + 3$ b. $f(x) = -2(3^x) - 1$ c. $f(x) = 4\left(2^{-2x+3}\right) - 7$

15. A bucket contains 1425 mL of water. The capacity of water in the bucket decreases 2.8% every 20 min. What is the equation models the situation? How much water is in the bucket in 50 min? when will the water level be at 900mL?

16. An exponential function with a base of 3 has been compressed horizontally by a factor of 2 and reflected in the *y*-axis. Its asymptote is the line $y = 3$. Its *y*-intercept is (0, 6). Write an equation of the function and state its domain and range.

17. The function $f(x) = -5(3^{4x+16}) + 7$ is the result of transformations. State the base function and describe the sequence of transformations.

18. What is the difference between exponential growth and exponential decay?

19. Each year a car loses 18% of its value from the previous year. A car was bought new for $35 000. Write the equation the represents the cars value after *n* years.
Find the value of the car after 5 years.

20. The half-life of a radioactive material is 5 hours. You started with 300 g.
a) Write an equation to represent the amount of radioactive material left.
b) How much radioactive material is left after 12 hours?
c) When will there be approximately 1 gram of the material left?

21. The population of the beluga whale is currently (in2012) 1000 animals. It's population is increasing by 6% every year.
a) Write an exponential relation that models the problem.
b) What will be the beluga's population in 2015?
c) What was the beluga's population in 1990?

Trigonometry (CH5) and Sinusoidal Functions (CH6)

1. Find how many triangles are possible and solve each if possible.

a. $B = 22°, b = 16.8, a = 22.42$

b. $B = 96°, b = 3, a = 24$

c. $a = 7, b = 9, B = 49°$

2. Determine the value of θ if $0° \leq \theta \leq 360°$

a. $\cot\theta = -0.5$	b. $\cos\theta = 0.935$	c. $\sin\theta = -0.764$
d. $\sin\theta = -0.45$	e. $\cos\theta = -0.23$	f. $\tan\theta = -4.2$
g. $\csc\theta = -10.54$	h. $\sec\theta = 4.25$	i. $\tan\theta = -3.853$

3. Determine the corresponding reciprocal ratio that corresponds to $\cos\theta = 0.8$.

4. Tim is standing on top of a cliff and sees a boat in the water. The boat is 200 m from shore and the angle of depression (from Tim's point of view) is 18°. How tall is the cliff?

5. A ladder is leaning against a wall, the foot of the ladder is 3m from the wall. The angle of elevation with the foot of the ladder is 56°, how long is the ladder?

6. Two cyclists leave from the same location with an angle of 63° between their paths. Jim cycles at a speed of 35 km/h and John at a speed of 40 km/h. How far apart are they after 3 h?

7. Two tracking stations, 5 km apart, track a weather balloon floating between them. The tracking station to the west tracks the balloon at an angle of elevation of 52°, and the station to the east tracks the balloon at an angle of elevation of 60°. How far is the balloon from the closest tracking station?

8. Point P(6, -3) lies on the terminal arm of an angle in standard position. What is the value of the principal angle θ to the nearest degree?

9. Determine 2 co-terminal angles with

a. 60° b. 153° c. 294° d. –278°

10. Find the exact value of;

a. tan 120º

b. sec 225º

c. . $\tan^2 45° - \cos 30°$

d. . $2\sin^2 60° \times \tan 30°$

e. $\cos 60° \times \sin 30°$

f. sin 315º

11. Given that $\tan\theta = -\frac{7}{5}$ and if angle θ is a principal angle that lies in quadrant 4 such that $0° \le \theta \le 360°$, determine;

a. the exact values of x, y, and r b. angle θ, to the nearest tenth of a degree   c. sec θ

12. Prove the following trigonometric identities

a. $\dfrac{\cos^2\theta - \sin^2\theta}{\cos^2\theta + \sin\theta\cos\theta} = 1 - \tan\theta$

b. $\tan^2\theta - \sin^2\theta = \sin^2\theta\tan^2\theta$

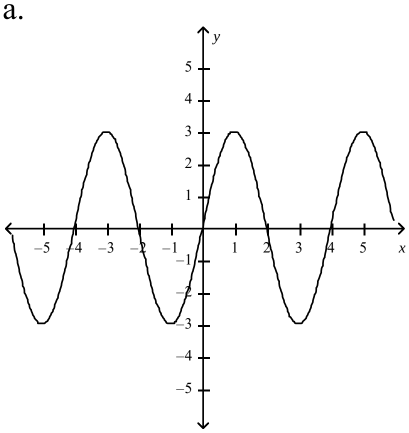
c. $\tan^2\theta - \cos^2\theta = \dfrac{1}{\cos^2\theta} - 1 - \cos^2\theta$

d. $\sin^2\theta + \cos^4\theta = \cos^2\theta + \sin^4\theta$

13. The angle θ is in Quadrant IV and csc θ = $-\frac{5}{\sqrt{7}}$. A point E lies on the terminal arm. Determine possible coordinates for E and the value of angle θ.

14. For each of the following determine the period, amplitude, domain, range, phase shift, vertical translation.

a.



b. $y = 4\sin x - 7$

c. $y = \cos(2x) - 1$

d. $d(t) = 6\cos(60t) - 2$

e. $y = 0.125\sin(x + 36°)$

f. $y = 3\cos(x + 60°) + 1$

g. $y = -4\sin(5x - 150) - 3$

15. Graph the following sinusoidal functions, where $-180° \le x \le 360°$.

a) $y = -3\sin 4x + 1$

b) $y = 2\cos\left(x - 120°\right) - 3$

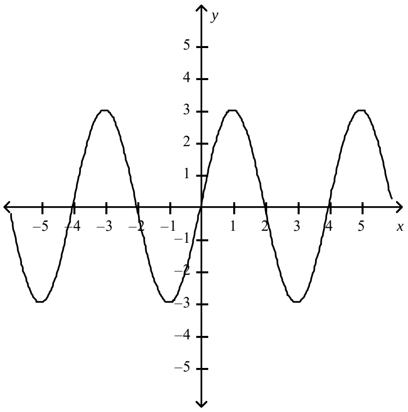
16. The graph of the function of y = sin x is transformed as described below. Determine the equation that causes each of the following transformations

a. Vertical stretch by 5 and translate the graph 7 units up

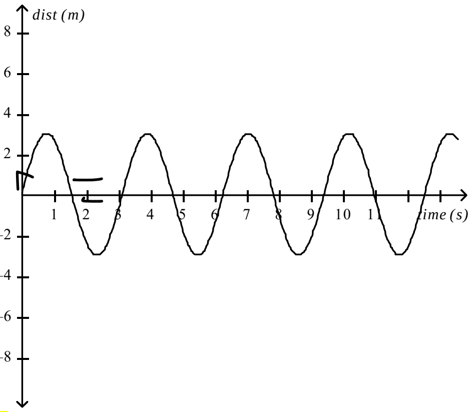
b. Reflected on the x – axis, compressed the graph horizontally by a factor of 5 and translate left by 150º.

17. For each of the following graphs state the period, then the equations using sine AND using cosine

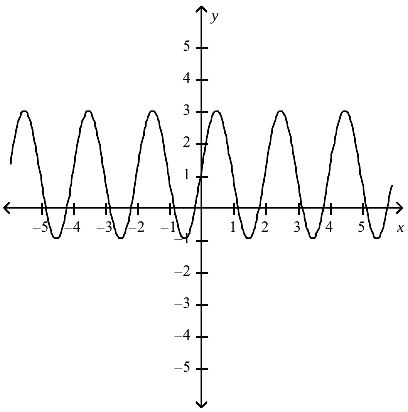
a.



b.



c.



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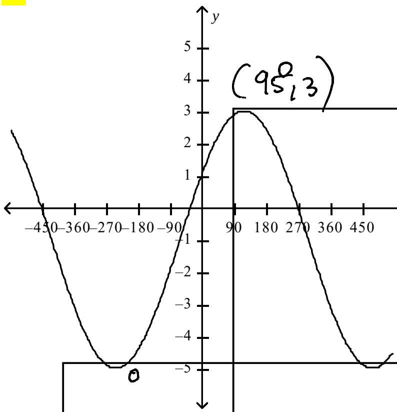
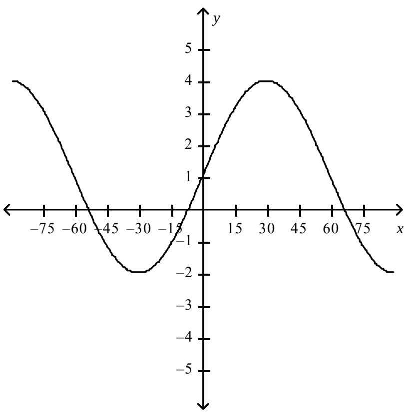
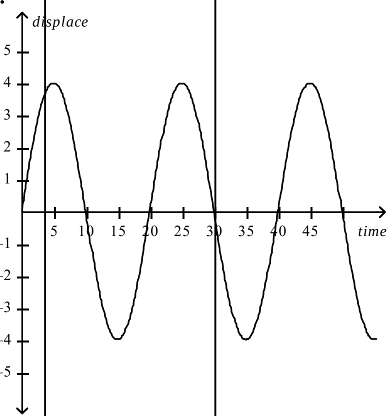


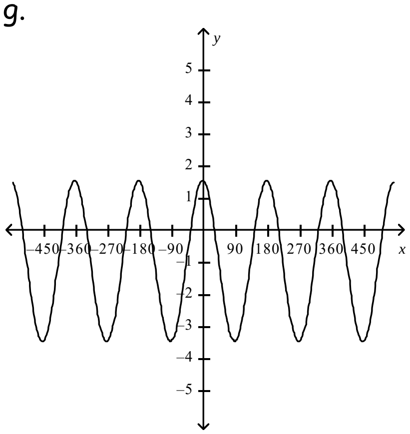
e.



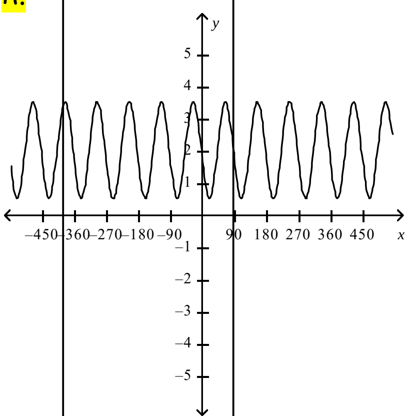
f.



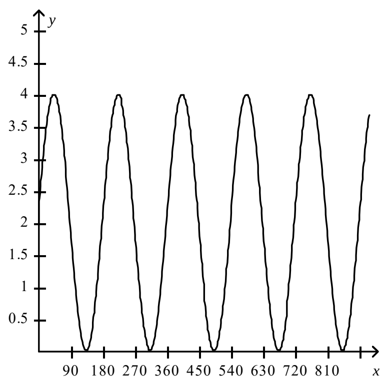
g.



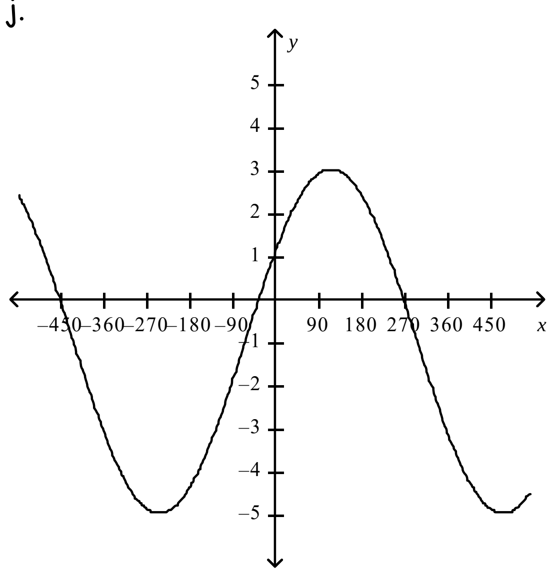
h.



i.



j.



18. The depth of the water in an ocean harbour varies due to the tides and can be modelled using the equation $y = a\sin[k(x + b)] + d$. High tide occurs at 5:00 A.M. with a water depth of 16 m and low tide occurs at 5:00 P.M. with a water depth of 5 m.
(a) Sketch its graph.
(b) Determine the equation that models this relationship if $t = 0$ at midnight.
(c) Determine the water depth at 2:00 P.M.

19. Consider the periodic function $f(x) = 2\sin[4(x + 60)] - 2$. State the

i. Phase shift
ii. Period
iii. Vertical displacement
iv. Amplitude
v. Domain
vi. Range

Graph the function between –180° to 360°.

20. A person who was listening to a siren reported that the frequency of the sound fluctuated with time, measured in seconds. The minimum frequency that the person heard was 100 HZ, and the maximum frequency was 500 Hz. The maximum frequency occurred at t = 0 and t = 15. The person also reported that, in 15s, she heard the maximum frequency 6 times (including the times at t = 0 and t = 15).
a. Graph the function
b. Write and equation that models the sound.
c. What frequency is heard at 1.3 s?
d. Find **all** the different times within 2 cycles when the frequency is 400 Hz?

21. The building sways 25 cm back and forth from the vertical. At t = 10s, the building is 25 cm to the right (+25) of the vertical. The building sways back to the vertical. At t = 30s, the building sways 25 cm to the left(-25) of the vertical.
a) Write an equation that models the motion of the building in terms of time.
b) What position is the building in at 15 s?
c) Find the two times within one cycle that the building is at -20cm?

22. The number of hours of daylight in Vancouver can be modeled by a sinusoidal function of time, in days. The longest day of the year is June 21st (day 172), with 15.7 h of daylights. The shortest day of the year is December 21st (Day 355), with 8.3 h of daylight.
a. Graph the function
b. Make and equation
c. Find the amount of sunlight on Feb 14th.

Series and Sequences (CH7) and Financial (CH8)

1. For the following sequences make the recursive formulas

a. 5, 10, 20, ….. b. 5, 10, 15, 20, ……. c. 5, 6, 8, 11, 15, ……

2. Consider the series -18 -14 -10 - …., find each of the following

a. The general term, t_n. b. The 15th term c. The sum of the first 20 terms

3. Determine whether the sequence is geometric, arithmetic, or neither. Try to come up with general t_n formulas

a. 8, 42, 76, 110, …
b. 13, 17, 21, 25, 29, ...
c. 1, 4, 7, 10, 13, …
d. $\frac{3}{2}, 1, \frac{2}{3}, \frac{4}{9}, \frac{8}{27}, \ldots$
e. 6, 42, 294, 2058,14406, …
f. 7, 13, 19, 25, 31, …...
g. 6, -18, 54, -162, ……
h. 59, 57, 55, 53,…….
i. 6, 12, 24, 48, ……
j. 349, 321, 293, 265, …
k. $4, -6, 9, -\frac{27}{2}, \ldots$

4. The 5th term of a sequence is 5. If the first term is -7, then what is the common difference?

5. If the 7th term in a geometric sequence is 448 and the common ratio is 2, then what is the first term?

6. The 6th term of an arithmetic sequence is 19, and the 13th term is 37. What is the first term?

7. Calculate the sum of the series: 3 + 1 – 1 – 3 – 5 …….. -53.

8. Calculate the sum of the series $8 + 6 + \frac{9}{2} \ldots + \frac{19683}{32768}$.

9. Expand and simplify the binomial power

a. $(3x-4y)^4$ b. $\left(\sqrt{3}-\sqrt{4}\right)^5$ c. $(2-3x)^5$

10. How many compounding periods are there in the investment below? Determine the interest rate per compounding period.

a.

Principal	Rate of Compound Interest per Year	Compounding Period	Time
$11 000	2.8%	quarterly	8 years

b.

Time of payment	Length of annuity	Interest rate per year	Frequency of compounding
end of every 6 months	7 years	5.1%	semi-annually

c.

Time of payment	Length of annuity	Interest rate per year	Frequency of compounding
end of every 6 months	13 years	18.2%	semi-annually

11. A principal of \$4500 is invested at 6% per year. Determine the interest earned in 7 years if the interest is

a. Simple interest
b. Compound interest, compounded annually
c. Compound interest, compounded quarterly

12. Determine the amount of an ordinary simple annuity of \$500 deposited each month for 7 years at 5.3% per year compounded monthly.

13. Determine the present value of an ordinary simple annuity that pays \$2200 for 20 years at 2.8% per year compounded semi-annually.

14. Determine the monthly payment for a mortgage of \$350 000 at 4.4% per year compounded semiannually over 20 years. (Remember to covert semi-annual rate to monthly rate using $(1+m)^{12} = (1+s)^2$ formula)

15. Ray borrows \$10500 for 7 years at a fixed rate of simple interest. At the end of 7 years, he will have paid \$14,487.50 in total. What is the interest rate on Ray's loan?

16. The future value of an account is \$5849.14 in 6 years. If the rate of compound interest is 7.4%/a compounded quarterly, what is the principal investment?

17. George puts \$3500 down on a new car and finances the rest (makes monthly payments) at an interest rate of 10.8% compounded monthly.. Five years later, he paid \$29 597.78 for the principal and interest. How much did the car originally cost?

18. Janice is interested in purchasing a television. While shopping she notices a sign that says "Low monthly payments of only \$35.49". After speaking to the sales associate she discovers that these payments are on the credit card at an interest rate of 28% compounded monthly for 2 years.

a. How much does the television cost?
b. How much interest would Janice have to pay?

19. Tyshawn purchases a home of \$450 000.00, he has a 30% deposit. He finances the rest (makes monthly payments) at 5.4% compounded monthly for 21 years. How much interest will Tyshawn pay over the life of the mortgage?

20. A \$2000 investment earns 5% interest each year.

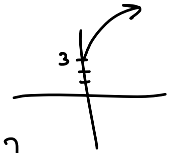
a. Suppose the investment earns simple interest. What will the investment be worth after 8 years?
b. Suppose the investment earns compound interest, where the interest is compounded annually. What will the investment be worth after 8 years?

21. Nicole borrowed \$25 000 to purchase her new car. The car dealership offered her a loan at 11.5% compounded monthly for 3 years. What is Nicole's monthly payment?

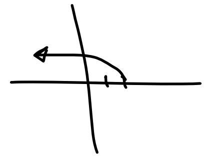
22. You need to borrow \$50,000 which option should you take repay the loan?
Option A: The loan payments are monthly and the interest is 10.5% compounded monthly over 4 years
Option B: The loan payments are quarterly (every 3 months) and the interest is 10.8% compounded quarterly over 4 years

$\boxed{CH1+2}$

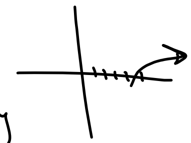
1 (a) parent $y=\sqrt{x}$
vert. stretch
shift up 3
$D=\{x\in\mathbb{R}, x\geq 0\}$
$R=\{y\in\mathbb{R}, y\geq 3\}$



(b) parent $y=\sqrt{x}$
reflect in y-axis
shift right 2
$D=\{x\in\mathbb{R}, x\leq 2\}$
$R=\{y\in\mathbb{R}, y\geq 0\}$

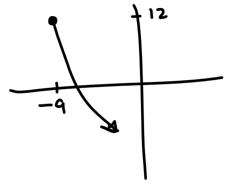


(c) parent $y=\sqrt{x}$
shift right 5
$D=\{x\in\mathbb{R}, x\geq 5\}$
$R=\{y\in\mathbb{R}, y\geq 0\}$

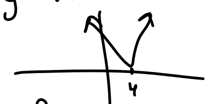


(d) parent $y=\sqrt{x}$
$f(x)=\sqrt{-1(x+6)}$
reflect in y-axis
shift left 6
$D=\{x\in\mathbb{R}, x\leq -6\}$
$R=\{y\in\mathbb{R}, y\geq 0\}$

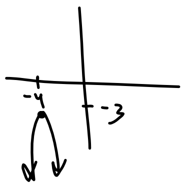
(e) parent $y=\sqrt{x}$
reflect in x-axis
vert. stretch
horiz. compress
left 9
up 12
$D=\{x\in\mathbb{R}, x\geq -9\}$
$R=\{y\in\mathbb{R}, y\leq 12\}$



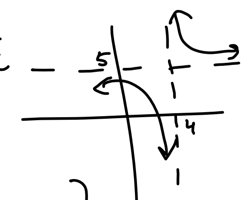
(f) parent $y=|x|$
$f(x)=|-1(x-4)|$
reflect in y-axis
right 4
$D=\{x\in\mathbb{R}\}$
$R=\{y\in\mathbb{R}, y\geq 0\}$



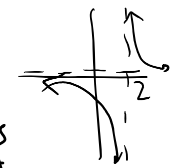
(g) parent $y=x^2$
reflect in x-axis
vertical stretch
left 4
down 3
$D=\{x\in\mathbb{R}\}$
$R=\{y\in\mathbb{R}, y\leq -3\}$



(h) parent $y=\frac{1}{x}$
vert. stretch
right 4 = VA
up 5 = HA
$D=\{x\in\mathbb{R}, x\neq 4\}$
$R=\{y\in\mathbb{R}, y\neq 5\}$



(i) parent $y=\frac{1}{x}$
$f(x)=\frac{1}{3(x-2)}$
horiz. compress
right 2 = VA
HA = 0
$D=\{x\in\mathbb{R}, x\neq 2\}$
$R=\{y\in\mathbb{R}, y\neq 0\}$



2 (d) 3 (b)

4 (a) $f(2)=-11$, $f(-3)=34$, $f(3)-f(5)=-20-(-38)=18$, $f^{-1}(x)=-\frac{1}{9}(x-7)$

(b) $f(2)=-9$, $f(-3)=-29$, $f(3)-f(5)=-29-(-93)=64$,
$f^{-1}(x)=\sqrt{-\frac{1}{4}(x-7)}$ OR $f^{-1}(x)=-\sqrt{-\frac{1}{4}(x-7)}$

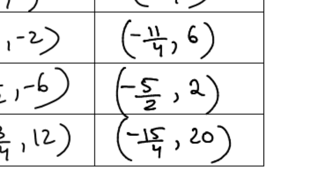
(c) $f(2)=0$, $f(-3)=-15$, $f(3)-f(5)=3-9=-6$, $f^{-1}(x)=\frac{1}{3}(x+6)$

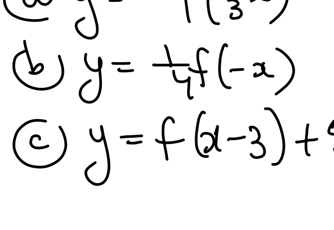
5 (a) $\{(5,-10)(9,-7)(6,0)(-12,8)\}$ (b) $f^{-1}(x)=x^2+5$ (c) $f^{-1}(x)=\frac{4x-18}{x-5}$

6 (a) $g(-6)=$ can't do not in domain (b) $g^{-1}(x)=\left(\frac{x-3}{2}\right)^2+5$

(c) $g^{-1}(-3)=14$
actually not in domain of inverse, see graph

(d)



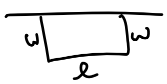


7

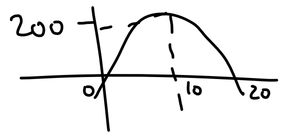
f(x)	f(4x) x÷4	2f(4x) y·2	−2f(4x) y·(−1)	−2f(4(x + 3)) + 8 x−3 and y+8
(0, 0)	(0,0)	(0,0)	(0,0)	(−3,8)
(1, 1)	$(\frac{1}{4},1)$	$(\frac{1}{4},2)$	$(\frac{1}{4},-2)$	$(-\frac{11}{4},6)$
(2, 3)	$(\frac{1}{2},3)$	$(\frac{1}{2},6)$	$(\frac{1}{2},-6)$	$(-\frac{5}{2},2)$
(-3, -6)	$(\frac{-3}{4},-6)$	$(-\frac{3}{4},-12)$	$(-\frac{3}{4},12)$	$(-\frac{15}{4},20)$

8 (a) $y=-f(\frac{1}{3}x)$
(b) $y=\frac{1}{4}f(-x)$
(c) $y=f(x-3)+5$

CH 1+2

9.) 

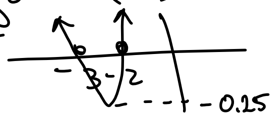
$40 = l + 2w \quad A = lw \quad \therefore A(w) = -2w^2 + 40w$
$= -2w(w-20)$



$D = \{w \in \mathbb{R}, 0 < w < 20\}$
$R = \{A \in \mathbb{R}, 0 < A < 200\}$

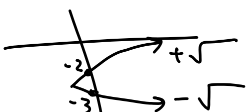
10 a) reflect in y-axis, compress horiz
b) $f(-1(x-5))$ reflect in y-axis, right by 5
c) reflect in x-axis, vert stretch, down 4

11) $g(x) = (x+3)(x+2)$

a) 

b) $D_g = \{x \in \mathbb{R}\}$
$R_g = \{y \in \mathbb{R}, y \geq -0.25\}$

c) $g(x) = (x+2.5)^2 - 0.25$ in vertex form
$g^{-1}(x) = \sqrt{x + 0.25} - 2.5$
or
$g^{-1}(x) = -\sqrt{x+0.25} - 2.5$

d) 

e) $D_{g^{-1}} = \{x \in \mathbb{R}, x \geq -0.25\}$
$R_{g^{-1}} = \{y \in \mathbb{R}, y \geq -2.5\}$ for $+\sqrt{}$

f) $g^{-1}(-6) =$ can't be found
not in domain

g) function only if
seperate out $+\sqrt{}$ and $-\sqrt{}$

12. a) $-4x^2 + 11xy$
b) $8x^3 - 36x^2 + 54x - 27$
c) $\frac{19}{6(2x-1)}, x \neq \frac{1}{2}$
d) $2a(a+1), a \neq 5, -6$
e) $5n^2 - 6n + 14$
f) $18v^2 - 7vw - 16w^2$
g) $\frac{23}{18}g - \frac{7}{24}h - 5$
h) $-8x^2 + 38x - 35$
i) $\frac{2}{9g}, g \neq 0$
j) $\frac{3x}{2}, x \neq -2$
k) $\frac{(d+5)^2}{5d(d-5)}, d \neq 0, 5$
l) $\frac{x-8}{x-10}, x \neq 10, -3$
m) $\frac{1}{10}, x \neq 0$
n) $\frac{3(p-2)}{(p+2)}, p \neq -1, -2$
o) $1, x \neq \frac{5}{4}$
p) $\frac{(2x+1)(x+4)}{(x+5)}, x \neq -4, 4, -3, -5$
q) $\frac{p^2 + 4p - 3}{(p+1)(p-1)}$ $p \neq -1, 1$
r) $\frac{-m^2 + 5m + 2}{3(m-1)(m-2)(m+2)}, m \neq 1, 2, -2$

13.) $A = (6x^2 + 7x - 5)\ cm^2$

14.) a) $(x+16)(x-3)$
b) $(g+5)(g^2+2)$
c) $6(x+3)^2$
d) $(x-4)^2 - 9y^2$
$= [x-4+3y][x-4-3y]$
e) $(3x+4)(3x-4)$
f) $(n+3)(n-2)(n+2)$
g) $2(q+6)^2$

15.) $A = \underset{l}{(x+9)}\underset{w}{(x^2+1)}$
$\therefore P = 2x^2 + 2x + 20$

CH. 3+4

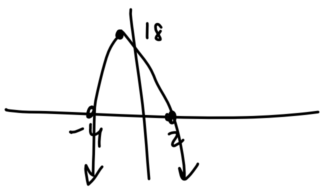
1.) $y=-2(x+4)(x-2)$

(a) zeros $(-4,0)$ $(2,0)$

(b) vertex $(-1,18)$

(c) MAX since $a=$neg

(d)



2.) (a) $y=-1(x-3)^2+2$

(b) $y=1(x+3)^2-4$

(c) $y=1(x-2)^2-1$

3) $y=-3(x+1)(x-2)$

4.) (a) $D=\{x\in\mathbb{R}\}$ $R=\{y\in\mathbb{R}, y\le -7\}$

$b^2-4ac=-28$ no roots

(b) $D=\{x\in\mathbb{R}\}$ $R=\{y\in\mathbb{R}, y\ge -\frac{121}{4}\}$

$b^2-4ac=121$ two roots

$x=7$ and $x=-4$

(c) $D=\{x\in\mathbb{R}\}$ $R=\{y\in\mathbb{R}, y\ge \frac{55}{32}\}$

$b^2-4ac=-55$ no roots

(d) $D=\{x\in\mathbb{R}\}$ $R=\{y\in\mathbb{R}, y\ge \frac{7}{4}\}$

$b^2-4ac=-7$ no roots

5) (a) $k>\frac{1}{2}$

(b) $k=\frac{13}{4}$

(c) $k>5/4$

6) (a) $20\sqrt{3}$ (b) $-6\sqrt{14}$ (c) $-26-25\sqrt{2}$ (d) $-\frac{2\sqrt{7}}{7}$ (e) $\frac{\sqrt{6}-1}{2}$

(f) $-\frac{1}{2}(\sqrt{42}+3\sqrt{7}+2+\sqrt{6})$ (g) can't (h) 16 (i) $6\sqrt{3}+9\sqrt{2}$

(j) $\frac{\sqrt{6}}{2}$ (k) $3\sqrt{2}+\sqrt{15}$

7.) (a) MAX $h=\frac{309}{20}=15.45$m (b) at $t=1.7$ sec

(c) depends if caught on the way up or down

(d) up $t=-\frac{17+3\sqrt{21}}{-10}\sim 0.03$ sec

down $t=-\frac{17-3\sqrt{21}}{-10}\sim 3.4$ sec

8.) (a) $h(t)=-\frac{5}{4}(t-4)^2+60$ (b) $t=4\sqrt{3}+4\sim 10.9$ sec (c) $h=\frac{235}{4}\sim 58.75$ m

9) Total Profit = (profit per bike)(quantity)

$P=(300+20x)(300-10x)$

$\therefore P=100\,000$ if $x=5$ or $x=10$

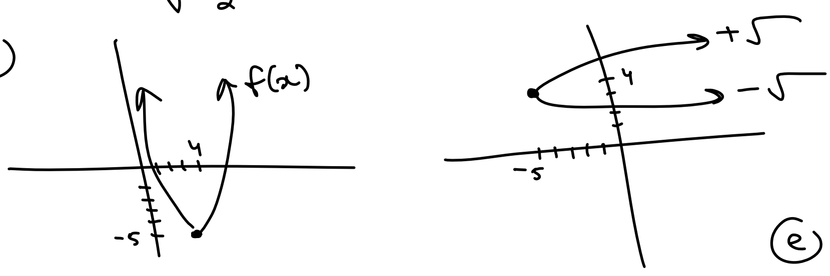
$\therefore$ MAX profit at $x=7.5$ $P=\$101\,250$

10) (a) POI $(6,15)$ and $(3,18)$

(b) POI $(1,3)$ and $(-\frac{3}{2},13)$

11) (a) $f^{-1}(x)=\sqrt{\frac{x+5}{2}}+4$ or $f^{-1}(x)=-\sqrt{\frac{x+5}{2}}+4$

(b)



(c) $D_f=\{x\in\mathbb{R}\}$

$R_f=\{y\in\mathbb{R}, y\ge -5\}$

(d) $D_{f^{-1}}=\{x\in\mathbb{R}, x\ge -5\}$

$R_{f^{-1}}=\{y\in\mathbb{R}, y\ge 4\}$ for $+\sqrt{}$

(e) the inverse is not a function unless seperate out $+\sqrt{}$ and $-\sqrt{}$

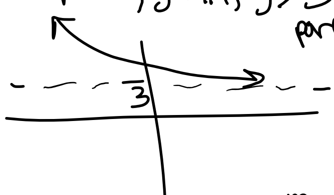
CH. 3+4

12. (a) $2^{-1} = \frac{1}{2}$ (b) $\left(\frac{2}{3}\right)^3 = \frac{8}{27}$ (c) $\frac{1}{\sqrt[3]{8}} = \frac{1}{2}$ (d) $\frac{1}{16^{1/2}} = \frac{1}{4}$

(e) $\left(\frac{1}{4}\right)^2 = \frac{1}{16}$ (f) $\frac{1}{\sqrt[3]{-27}} \times \sqrt[3]{27} = -1$

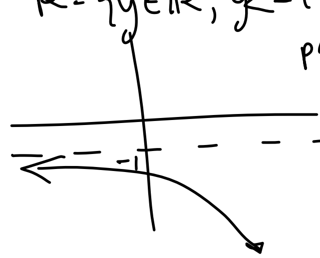
13. (a) $f(x) = 9^{-x} - 2$ (b) $f(x) = 2(9)^{3x}$ (c) $f(x) = -(9)^{x-5}$

14. (a) $y = \frac{1}{16}\left(\frac{1}{2}\right)^x + 3$
HA at $y=3$
$D = \{x \in \mathbb{R}\}$
$R = \{y \in \mathbb{R}, y > 3\}$



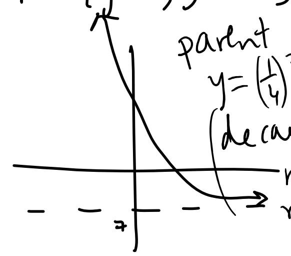
parent $y = \frac{1}{2}^x$
decay
(not reflected)

(b) $y = 2(3)^x - 1$
HA at $y = -1$
$D = \{x \in \mathbb{R}\}$
$R = \{y \in \mathbb{R}, y < -1\}$



parent $y = 3^x$
growth
(reflected becomes decay)

(c) $y = 32\left(\frac{1}{4}\right)^x - 7$
HA at $y = -7$
$D = \{x \in \mathbb{R}\}$
$R = \{y \in \mathbb{R}, y > -7\}$



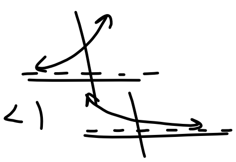
parent $y = \left(\frac{1}{4}\right)^x$
(decay not reflected)

15. $V(m) = 1425(0.972)^{m/20}$
$V = 1327.3$ mL at 50 min
$m \doteq 324$ min at 900 mL

16. $y = 3(3^{-2x}) + 3$
$D = \{x \in \mathbb{R}\}$
$R = \{y \in \mathbb{R}, y > 3\}$

17. parent $y = 3^x$
reflect in x-axis
horiz. compress
left 4
up 7

18. growth, base > 1
decay, 0 < base < 1



19. $V(n) = 35\,000(0.82)^n$
\$12 975.89

20. (a) $G(h) = 300\left(\frac{1}{2}\right)^{h/5}$
(b) 56.8 grams
(c) 41.1 hours

21. (a) $B(t) = 1000(1.06)^t$
(b) 1191 animals
(c) 278 animals

CH. 5 + 6 |

1) a) Solution 1: A = 30°, C = 128°, c = 35.3
Solution 2: A = 150°, C = 8°, c = 6.2

b) No triangle exists.

c) one triangle
A = 35.94°, C = 95.06°, c = 11.88

2) a) $\theta_1 = 117°, \theta_2 = 297°$ b) $\theta_1 = 21°, \theta_2 = 339°$ c) $\theta_1 = 230°, \theta_2 = 310°$

d) $\theta_1 = 207°, \theta_2 = 333°$ e) $\theta_1 = 103, \theta_2 = 257°$ f) $\theta_1 = 103°, \theta_2 = 283°$

g) $\theta_1 = 185°, \theta_2 = 355°$ h) $\theta_1 = 76, \theta_2 = 284°$ i) $\theta_1 = 105°, \theta_2 = 285°$

3) $\sec\theta = \frac{1}{0.8} = 1.25$ 4) 65.0 m 5) 5.4 m

6) 118.3 Km 7) 4.2 Km 8) 333°

9) a) $-300°, 420°$ b) $-207°, 513°$ c) $-66°, 654°$ d) $-638°, 82°$

10) a) $-\sqrt{3}$ b) $-\sqrt{2}$ c) $\frac{2-\sqrt{3}}{2}$ d) $\frac{\sqrt{3}}{2}$ e) $\frac{1}{4}$ f) $-\frac{\sqrt{2}}{2}$

11) a) $y = +7, x = +5, r = \sqrt{74}$ b) $\theta = 306°$ c) $\frac{r}{x} = \frac{\sqrt{74}}{+5}$

12) a) • factor diff. of sq + common

$LS = \frac{\cancel{(\cos\theta + \sin\theta)}(\cos\theta - \sin\theta)}{\cos\theta\cancel{(\cos\theta + \sin\theta)}}$

$= \frac{\cos\theta - \sin\theta}{\cos\theta}$

• distribute denom

$= \frac{\cos\theta}{\cos\theta} - \frac{\sin\theta}{\cos\theta}$

$= 1 - \tan\theta = RS$

$\therefore LS = RS$

b) $LS = \frac{\sin^2\theta}{\cos^2\theta} - \sin^2\theta$

• LCD

$= \frac{\sin^2\theta - \sin^2\theta(\cos^2\theta)}{\cos^2\theta}$

• common factor

$= \frac{\sin^2\theta(1 - \cos^2\theta)}{\cos^2\theta}$

• pythag

$= \frac{\sin^2\theta}{\cos^2\theta}(\sin^2\theta)$

$= \tan^2\theta \sin^2\theta = RS \therefore LS = RS$

c) $RS = \frac{1}{\cos^2\theta} - \frac{1}{1} - \frac{\cos^2\theta}{1}$

LCD

$= \frac{\cancel{1} - \cos^2\theta - \cos^4\theta}{\cos^2\theta}$

pythag

$= \frac{\sin^2\theta - \cos^4\theta}{\cos^2\theta}$

distribute denom

$= \frac{\sin^2\theta}{\cos^2\theta} - \frac{\cos^4\theta}{\cos^2\theta}$

$= \tan^2\theta - \cos^2\theta = LS$

$\therefore LS = RS$

d) $LS = \sin^2\theta + \cos^2\theta\cos^2\theta$

pythag

$= \sin^2\theta + (1 - \sin^2\theta)\cos^2\theta$

$= \sin^2\theta + \cos^2\theta - \sin^2\theta\cos^2\theta$

regroup + common factor

$= \sin^2\theta - \sin^2\theta\cos^2\theta + \cos^2\theta$

$= \sin^2\theta(1 - \cos^2\theta) + \cos^2\theta$

pythag

$= \sin^2\theta(\sin^2\theta) + \cos^2\theta$

$= \sin^4\theta + \cos^2\theta = RS$ $\therefore LS = RS$

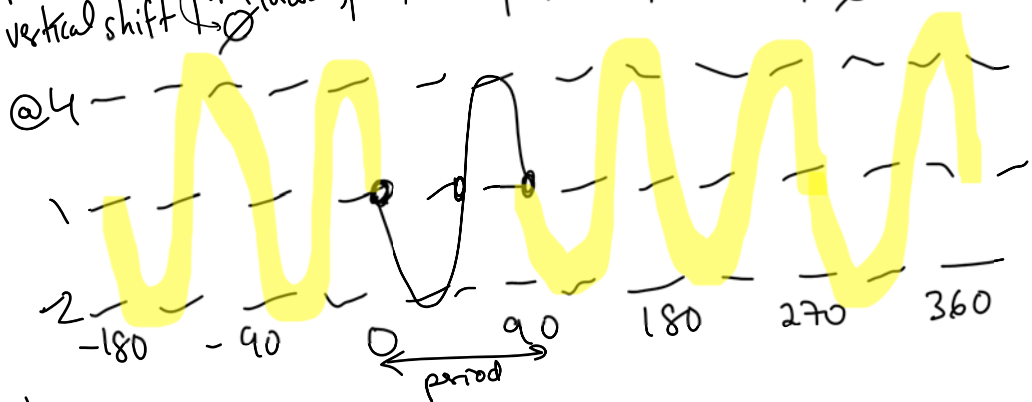
CH.5+6

13. $E = (3\sqrt{2}, -\sqrt{7})$ or $(4\sqrt{5}, -2\sqrt{7})$ or any other multiple $\theta = 328°$

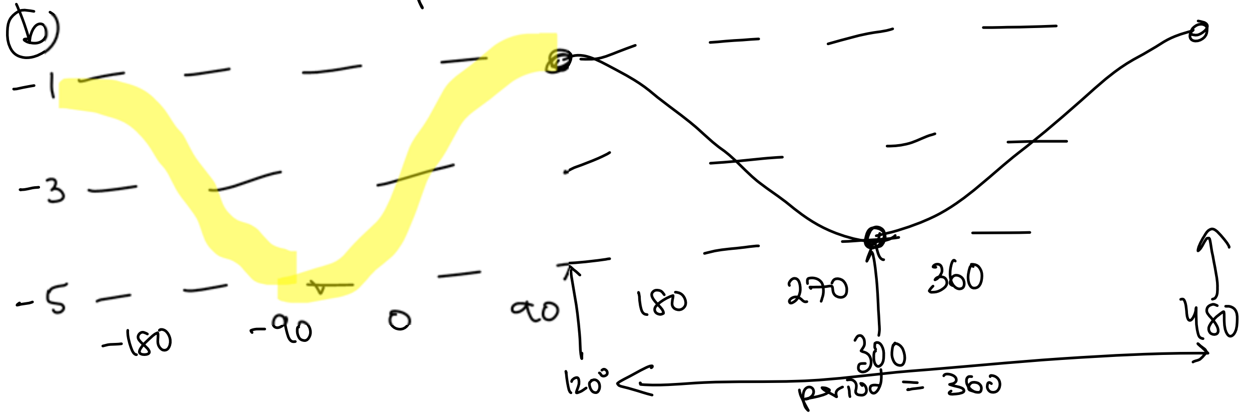
14.

	a	b	c	d	e	f	g
period	4	360°	180°	6	360°	360°	720°
amp	3	4	1	6	0.125	3	4
domain	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$	$x \in \mathbb{R}$
range	$-3 \le y \le 3$	$-11 \le y \le -3$	$-2 \le y \le 0$	$-8 \le y \le 4$	$-0.125 \le y \le 0.125$	$-2 \le y \le 4$	$-7 \le y \le 1$
phase shift	∅ for sine or 1 for cosine	∅	∅	∅	−36° (left)	−60° (left)	30° (right)
vertical shift	∅	−7	−1	−2	∅	1	−3

15. a)



b)



16. a) $y = 5\sin x + 7$

b) $y = -\sin[5(x + 150°)]$

17. a) period = 4

$y = 3\sin 90° x$

$y = 3\cos 90°(x - 1)$

b) period ≤ 3.14 = π

$k = \frac{2\pi}{p} = \frac{2\pi}{\pi} = 2$

$y = 3\sin\left(\frac{360°}{\pi}x\right)$ in degrees or $y = 3\sin[2x]$ in radians

$y = 3\cos\left[\frac{360°}{\pi}\left(x - \frac{\pi}{4}\right)\right]$ or $y = 3\sin\left[2\left(x - \frac{\pi}{4}\right)\right]$

c) period = 2

$y = 2\sin[180° x] + 1$

$y = 2\cos[180°(x - 0.5)] + 1$

d) period = 720°

$y = 4\sin[0.5(x + 85)] - 1$

$y = 4\cos[0.5(x - 95)] - 1$

$\boxed{\text{CH. 5+6}}$

17. e) period = 120
$y = 3\sin 3x + 1$
$y = 3\cos(3(x-30)) + 1$

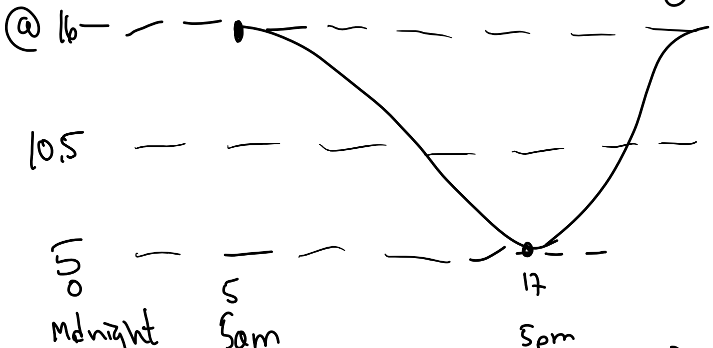
f) period = 20
$y = 4\sin 18x$
$y = 4\cos(18(x-5))$

g) period = 180°
$y = 2.5$

h) period = 90°
$y = -1.5\sin 4x + 2$
$y = -1.5\cos[4(x-22.5)] + 2$

i) period = 180°
$y = -2\sin[2(x-90)] + 2$
$y = 2\cos[2(x-45)] + 2$

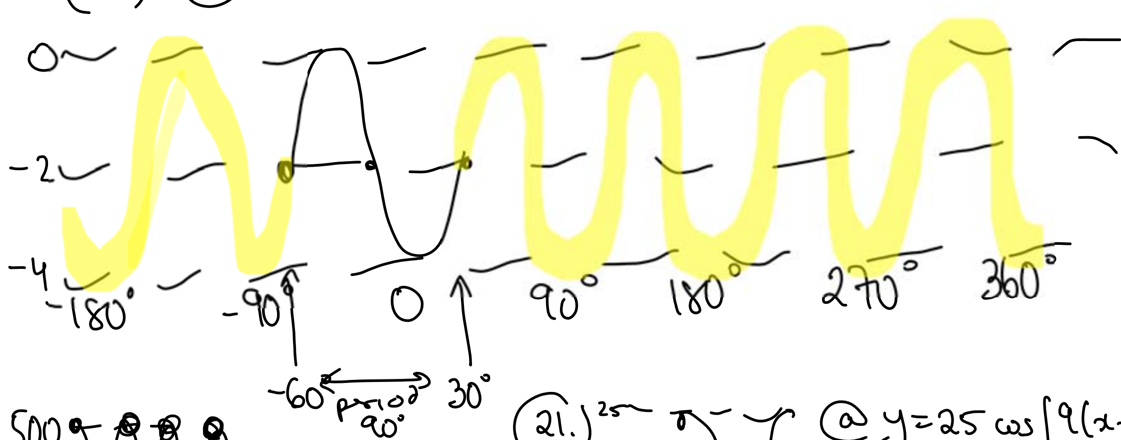
j) period = 720°
$y = 4\sin[0.5(x+80)] - 1$
$y = 4\cos[0.5(x-100)] - 1$
hard to tell (approx..)

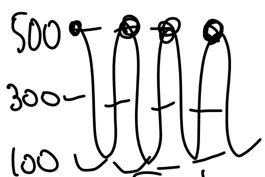
18. a)


b) $D(t) = 5.5\cos\left[\frac{360°}{24}(t-5)\right] + 10.5$

c) $D(14) \doteq 6.6$ m

19. i) −60 (left) ii) 90° iii) −2 (down) iv) 2 v) $x \in \mathbb{R}$ vi) $-4 \le y \le 0$

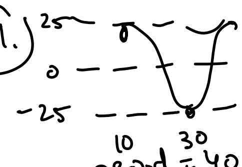


20. a)


5 cycles within 15 sec $p = \frac{15}{5} = 3$

b) $y = 200\cos[120°x] + 300$ add period 3

c) 117 Hz d) $x_1 = 0.5, 2.5, 3.5, 5.5$

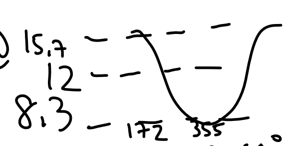
21.


period = 40

a) $y = 25\cos[9(x-10)]$

b) 17.7 cm to the right

c) $X_1 = 25.9, 34.1$

22. a)


b) $y = 3.7\cos\left[\frac{360°}{365}(x-172)\right] + 12$ or 366?

c) Day = 45 has 9.9 hours of daylight

CH. 7 + 8

1. a) $t_n = (t_{n-1}) \times 2,\ t_1 = 5$ b) $t_n = (t_{n-1}) + 5,\ t_1 = 5$ c) $t_n = (t_{n-1}) + n - 1,\ t_1 = 5$

2. a) $t_n = 4n - 22$ b) $t_{15} = 38$ c) $S_{20} = 400$

3. a) arith. $t_n = 34n - 26$ b) arith. $t_n = 4n + 9$
c) arith $t_n = 3n - 2$ d) geo $t_n = \frac{3}{2}\left(\frac{2}{3}\right)^{n-1}$
e) geo $t_n = 6(7)^{n-1}$ f) arith $t_n = 6n + 1$
g) geo $t_n = 6(-3)^{n-1}$ h) arith $t_n = -2n + 61$
i) geo $t_n = 6(2)^{n-1}$ j) arith $t_n = -28n + 377$
k) geo $t_n = 4\left(\frac{-3}{2}\right)^{n-1}$

4. $d = 3$ 5. $a = 7$ 6. $a = \frac{43}{7}$ 7. $S_{29} = -725$

8. $S_{10} = \frac{989527}{32768}$ 9. a) $81x^4 - 432x^3y + 864x^2y^2 - 768xy^3 + 256y^4$
b) $209\sqrt{3} - 362$
c) $32 - 240x + 720x^2 - 1080x^3 + 810x^4 - 243x^5$

10. a) $n = 32$ $i = \frac{0.028}{4}$ b) $n = 14$ $i = \frac{0.051}{2}$ c) $n = 26$ $i = \frac{0.182}{2}$

11. a) $I = \$1890$ b) $I = \$2266.34$ c) $I = \$2327.50$

12. $FV = \$50\,716.95$ 13. $PV = \$67032.14$

14. use $(1 + \text{monthly})^{12} = (1 + \text{semiann})^2$
to find monthly rate $= m = \frac{i}{2}$
$(1 + m)^{12} = \left(1 + \frac{0.044}{2}\right)^2$
$m = 0.0036335$

$350\,000 = R\left[\frac{1 - (1 + 0.0036335)^{-240}}{0.0036335}\right]$
$350000 = R(159.9672)$
$\$2187.95 = R$
is the monthly payment

15. $r = 5.425\%$ 16. $P = \$3767.27$
$A = P(1+i)^n$

17. use $R \cdot n$ to find $R = 493.30$
then PV to find $PV = 22792.78$
then add deposit 3500 $\therefore$ 26 292.78

18. a) \$646.58 b) \$205.18 19. deposit 135 000, $PV = 315\,000$, $R = 2092.45$
$\therefore I = 212\,296.44$

20. a) \$2800 b) \$2954.91 21. \$824.40 22. A: $R = 1280.17$ B: $R = 3889.81$
$\times 48$ $\times 16$
total = \$61448.16 total = \$62 236.96
$\therefore$ option A is better