

Date: \_\_\_\_\_

Name: \_\_\_\_\_

# Review for FINALS

FINAL EXAM date \_\_\_\_\_



## Success Criteria

- Ensure your Journals are complete and corrected for studying purposes
- Complete the given Review booklet. Check your answers online.

## FORMULAS GIVEN ON EXAM:

### FORMULAS:

#### Addition and Subtraction Formulas

$$\sin(x + y) = \sin x \cos y + \cos x \sin y$$

$$\sin(x - y) = \sin x \cos y - \cos x \sin y$$

$$\cos(x + y) = \cos x \cos y - \sin x \sin y$$

$$\cos(x - y) = \cos x \cos y + \sin x \sin y$$

$$\tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$$

$$\tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$$

#### Key Identities

$$1 + \tan^2 \theta = \sec^2 \theta \quad 1 + \cot^2 \theta = \csc^2 \theta$$

$$\sin(-\theta) = -\sin \theta \quad \cos(-\theta) = \cos \theta$$

$$\tan(-\theta) = -\tan \theta \quad \sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta$$

$$\cos\left(\frac{\pi}{2} - \theta\right) = \sin \theta \quad \tan\left(\frac{\pi}{2} - \theta\right) = \cot \theta$$

#### Double Angle Formulas

$$\sin 2x = 2 \sin x \cos x \quad \cos 2x = \cos^2 x - \sin^2 x$$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x} \quad = 2 \cos^2 x - 1$$

$$= 1 - 2 \sin^2 x$$

## On Exam:

CAN NOT use Journals

But formula page is provided

Total 14 pages & 19 questions (some with a,b,c...) no multiple choice

**MHF 4U1 Mrs.K's Review For Exam**

1. Sketch each of the following

a.  $y = 0.5^x - 2$

b.  $y = 3(1.5)^{-x}$

c.  $y = -2(5)^x + 6$

d.  $y = -2\sin[\pi x - 3\pi] + 4$

e.  $y = \tan\left(\frac{\pi}{2}x + \pi\right)$

f.  $y = \csc(2x) - 3$

g.  $y = \frac{1}{x^2 - x - 6}$  find the eqtns of all asymptotes

h.  $y = \frac{1}{x^2 + 3x + 4}$  find the eqtns of all asymptotes

i.  $y = \frac{x + 2}{x^2 - 4x + 4}$  find the eqtns of all asymptotes

j.  $y = \frac{2x - 3}{x + 6}$  find the eqtns of all asymptotes

k.  $y = \frac{5 - x}{2x - 8}$  find the eqtns of all asymptotes

l.  $y = \frac{x^2 - 9}{x - 2}$  find the eqtns of all asymptotes

m.  $y = \frac{2x^2 - 5x - 3}{x + 4}$  find the eqtns of all asymptotes

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

Sketch, state end behaviour, # of possible zeros, # of possible turning points

o.  $y = -2x^3 - 3x^2 + 11x + 6$

Sketch, state end behaviour, # of possible zeros, # of possible turning points

2. Determine the inverse for 1a, b, c, j, k.

3. Sketch the inverses in 2. (~~these~~ will all be LOGS)

4. Prove

a.  $(\cos x - \sin x)^2 = 1 - \sin 2x$

b.  $2 \cos x \cos y = \cos(x + y) + \cos(x - y)$

c.  $(\csc x - \cot x)^2 = 1 - \frac{2 \cos x}{1 + \cos x}$

5. Solve

a.  $2 \sec^2 x + \sec x - 1 = 0$

b.  $\tan x \cos^2 x - \tan x = 0$

c.  $2 \cos^2 x + \sin x - 1 = 0$

6. Find exact values for

a.  $\sin\left(\frac{7\pi}{12}\right)$

b.  $\sin\left(\frac{7\pi}{6}\right)\cos\left(\frac{4\pi}{3}\right) - \cos\left(\frac{5\pi}{4}\right)\tan\left(\frac{5\pi}{6}\right)$

c.  $\cos\left(\frac{3\pi}{8}\right)$

7. Solve

a.  $\frac{500}{x} + x < 60$

b.  $x^3 + 5x^2 + 2x - 8 \geq 16x - 8$

c.  $\frac{2x + 1}{2x - 3} \geq \frac{x + 1}{x - 5}$

d.  $5^{2x+2} - 3126(5^x) = -125$

e.  $\log_5(x + 1) + \log_5(x - 3) = 1$

f.  $2 \tan x = \sqrt{3} \tan^2 x - \sqrt{3}$

g.  $\sqrt{2x - 1} + \sqrt{x + 11} = 7$  **extra NOT on exam!**

h.  $\log_9 \frac{9}{5} x = \log_9 \frac{63}{10} + \log_9 2$

i.  $\log_5 x - 2 \log_{\frac{1}{2}} 2^{-1} = 2$

j.  $\left(\frac{1}{3}\right)^x = \sqrt[16]{81}$

k.  $2^{x-1} = 6^x$

l.  $|2x + 3| \geq 5$

m.  $\frac{600}{x-5} = \frac{600}{x} + 20$

8. You board a Ferris wheel of 49m radius at a height of 1m off the ground. The wheel rotates at 2 rotations per minute.

a. Write an equation of height in meters versus time in seconds. Do both cosine and sine.

b. At what two times in one cycle are you 90m off the ground?

c. How high are you after 5 min 20 sec?

d. What is the average rate of change on the time interval of [0, 10] seconds?

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9. At high tide the water is at 9 feet. At low tide it is at 3 feet. One day the low tide occurred at 3am and high tide at 9am

- Find the equation that models this if  $t=3$  is 3am. Do both sine and cosine.
- What is the water level at 2pm?

10. Find a real number that exceeds its cube by  $\frac{15}{8}$

11. A mass of 1200 grams decays at a half life of 4 weeks.

- Write the equations for the mass in terms of weeks, months and years.
- At what time is there only 0.5 grams left?
- After 2 days what is the mass?
- What is the average rate of change of mass during the 1<sup>st</sup> two weeks?

12. A certain bacteria triples every 5 seconds. What are the equations that model this in seconds, in minutes and in hours?

13. You kick a ball 2m away from the net so it lands 7m away from the net. As it flew through the air it reached a maximum height of 3m.

- What is the equation to model this?
- Find the rate of change of height versus horizontal distance when the ball is 5 m away from the net.

14. For  $f(x) = 3x - 2$  on  $[0, 6]$  and

$$g(x) = x^2 - 6x \text{ on } [-1, 4]$$

$$h(x) = \{(3, 2), (5, 1), (7, 4), (9, 3), (11, 5)\}$$

$$i(x) = \{(1, 3), (2, 5), (3, 7), (4, 9), (5, 11)\}$$

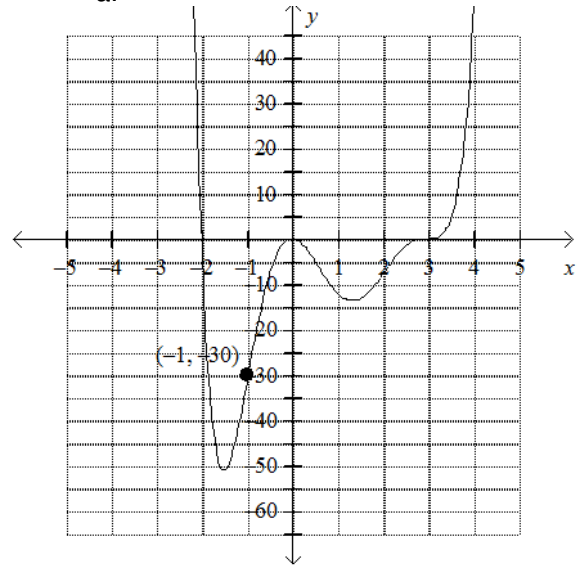
Find

- $(f - g)(x)$
- $(f \div g)(x)$
- $(f \circ g)(x)$
- $(h + i)(x)$
- $(h \circ i)(x)$

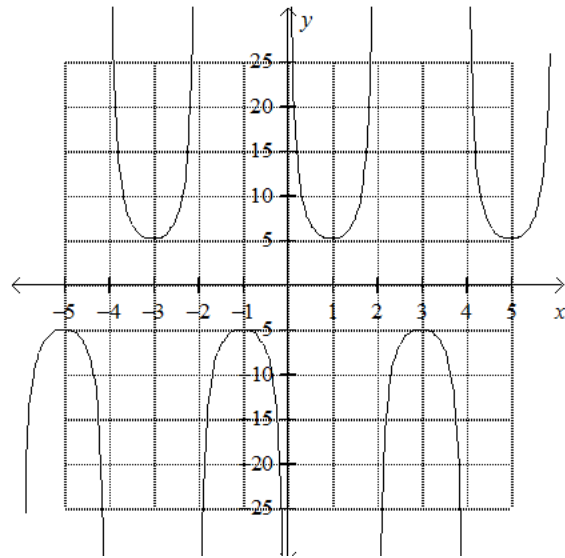
(be able to match graphs for exam too)

15. State the equations for

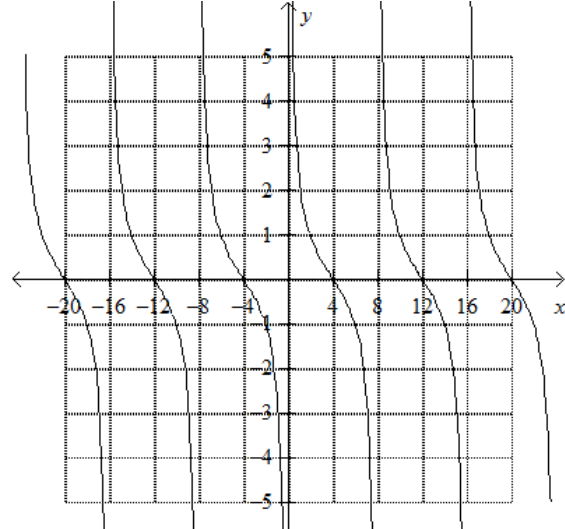
a.



b.



c.



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16. For 15a.

- State when  $f(x) < 0$
- State when  $f(x) \geq -10$
- State an interval where average rate of change would be negative.
- State a point where instantaneous rate of change would be zero.

17. A grade school is taking a trip to the zoo. A parent group of 6 people is responsible for putting together 225 box lunches for the trip. The group hopes to recruit extra people for the task.

- Write an equation that gives the average number "n" of box lunches made per person as a function of the number "p" of parents that can come in and help complete the task.
- Sketch the equation.
- State the valid domain for this situation.
- How many people need to come in so that the average number of box lunches made per person is 15 box lunches?

18. A motorboat travels 30 miles up a river and returned a distance of 27 miles. The entire trip takes 5 hours. If the rate of the motorboat in still water is 12 mph, find the rate of the current of the river.

19. Ero and Jamal set off at the same time on a 30km walk for charity. Ero, who has trained all year for this event, walks 1.4km/h faster than Jamal, but sees a friend on the route and stops to talk for 20 min. Even with this delay, Ero finishes the walk 2 hrs ahead of Jamal. How fast was each person walking?

20. If constructing a box with a square base with a volume of 1000 cubic inches. The material for the top and bottom are \$3 per 100 square inch and the material for the sides costs \$1.25 per 100 sq. in.

- If  $x$  is the length of the side of the base, what is the cost in terms of  $x$ ?
- For what dimensions will the cost be \$39.50?

21. For each of the following find the end behaviour, the possible number of turning points and possible number of zeros.

- $f(x) = -x^3 + 2x^4 - 6$
- $g(x) = -2x^5 + 2x^4 + x - 8$

22. For each of the following tables

- Determine what type of relationship is given
- Determine an equation to model the relationship

i)

x	y
-6	0.3
-1	0.6
4	1.2
9	2.4
14	4.8
19	9.6
24	19.2

ii)

x	y
0.2	2
0.6	5
1.	8
1.4	11
1.8	14
2.2	17
2.6	20

iii)

x	y
-2	29
-1	20
0	13
1	8
2	5
3	4
4	5

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23. A wheel is rotating at an angular velocity of  $80\pi$  radians/minute, while a point on the circumference of the wheel travels  $10\pi$  meters in 15 seconds.
- Find the radius of the wheel
  - Find the period in seconds.
  - State the equations in both sine and cosine to model the height versus time in seconds if the axle of the wheel is located 3 meters off the ground and the position at time zero is at minimum.
  - Within first 4 seconds find all the different times that a point on the circumference is 2.7 meters off the ground.

24. A ferris wheel has a diameter of 140 meters and completes one revolution in 30 minutes.
- Find angular velocity in radians/second.
  - Find linear velocity in kilometers/hour
  - Find how far (the curved length) a person has traveled in kilometers over 160 minutes.
  - What is the period in minutes of this situation?
  - Write an equation using cosine that would model this situation if you assume that the bottom of the wheel is 1 meter off the ground and the person gets on at 71 meters off the ground at time 0 minutes and then goes down.
  - Write an equation using sine that would model this situation if you assume that the bottom of the wheel is 3 meters under ground and the person gets on at ground level at time 0 minutes and then goes up.

25.  $f(x) = x^4 + 1$

- Find a.r.o.c on  $x \in [-2, 4]$
- Find i.r.o.c at  $x=3$

26. Find domain algebraically, then sketch and find range graphically

a.  $a(x) = \sqrt{2x-5} + 3$

b.  $b(x) = 3\log_5(14-7x) - 4$

c.  $c(x) = \frac{x-11}{2x^2-15x-8}$

d.  $d(x) = 2x^2 - 8x - 10$

e.  $e(x) = -2(3.5)^x - 6$

f.  $f(x) = 4 - \sqrt{5-10x}$

g.  $g(x) = -2|x+5|$

h.  $h(x) = \begin{cases} x+2, & x \leq -3 \\ 4^x, & 0 < x \leq 5 \end{cases}$

i.  $i(x) = 4\log_{0.5}(2x-1)$

j.  $j(x) = \frac{3x^2}{2x^3 + 3x^2 - 18x + 8}$

k.  $k(x) = \frac{2}{5}x + 6$

l.  $l(x) = \sqrt[3]{2x+6} - 8$

m.  $m(x) = \frac{4}{x^2+1}$

n.  $n(x) = -2\sin(\pi(x+4)) + 9$

o.  $o(x) = \tan 4x + 1$

p.  $p(x) = x^3(x-5)^2(x+1)$