TORONTO DISTRICT CHRISTIAN HIGH SCHOOL

FINAL EXAM

MATH 11 UNIVERSITY (MCR3U)

Jan 23, 2024 Name:_____

2 hours Teachers: J. Templeton

	Mark Breakdown:
Knowledge and Understanding	21
Thinking	22
Communication (*including 4 for presentation*)	10
Application	27
Total:	80

Notes:
You must stay for the entire time.

You may use a ruler and/or a calculator.

"For in Christ all the fullness of the Deity lives in bodily form, and you have been given fullness in Christ" – Col $2^{9\text{-}10a}$

Multiple Choice K ___/7

Identify the choice that best completes the statement or answers the question.

___ 1. Which relation is a function?

a. {(–3, –2), (–1, 3), (0, –2), (3, 4)}
b. {(0, 1), (3, 2), (5, –3), (0, 2)}
c. {(–7, –7), (–2, 5), (–1, 6), (–2, –5)}
d. {(–4, –7), (–9, 5), (4, –2), (–9, 0)}

___ 2. Evaluate $f(x) = -4x^2 + 7$ for $f(1) + f(-2)$.

a. –6
b. 3
c. 26
d. 94

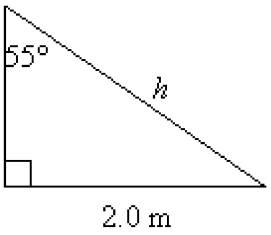
___ 3. Which of the following expresses $\sqrt{96}$ in simplest form?

a. $6\sqrt{3}$
b. $16\sqrt{6}$
c. $4\sqrt{6}$
d. $8\sqrt{2}$

___ 4. Which of the following is equivalent to the expression $\left(a^3b^4\right)^{-2}\left(a^{-3}b^{-5}\right)^{-4}$?

a. a^6b^{12}
b. $a^{12}b^{15}$
c. $\dfrac{1}{a^6b^{12}}$
d. $\dfrac{1}{a^6b^7}$

___ 5. Determine the length of the hypotenuse of the triangle to the nearest tenth of a metre.

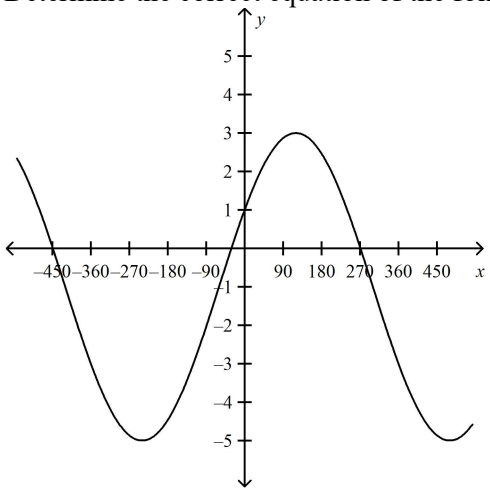


a. 3.1 m
b. 2.4 m
c. 2.1 m
d. 2.9 m

___ 6. Without graphing, determine the period of the function $y = 3.7\sin(15x) - 0.1$.

a. 24
b. 15
c. 30
d. 3.7

___ 7. Determine the correct equation of the following graph.



a. $y = 4\cos(2x - 60°) - 1$
b. $y = 4\cos(0.5x - 60°) - 1$
c. $y = 4\cos(2x + 30°) - 1$
d. $y = 4\cos(0.5x + 30°) - 1$

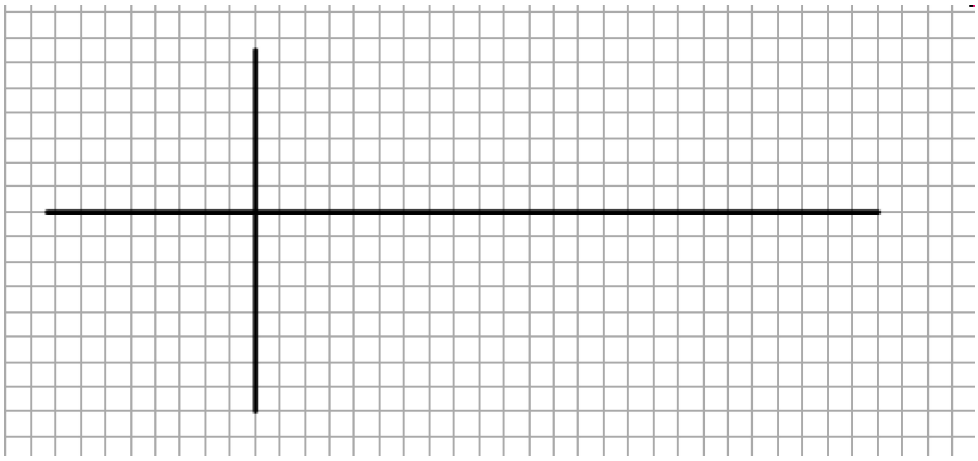
Full Solution - *Note- there are upto 4 Communication points available for presentation of your mathematics.*

8. Given $f(x) = \sqrt{3(x+2)} - 1$,

a) What is the parent function for $f(x)$? [K:1]

b) State all the transformations contained in $f(x)$. Also, state the domain of $f(x)$. [K:3]

c) Sketch the graph of $f(x)$. (Using a table of values may help) [K:3]



9. Simplify fully. State the restrictions for each expression. [T:6,4]

a) $\frac{x^2-7x-3}{x^2-12x+} \div \frac{6x^2+18x}{6x^3-12x^2}$

b) $\frac{4x}{x+1} + \frac{3}{x-2}$

10. Given the general quadratic function $f(x) = -3(x-1)^2 + 2$ state: [K:1, C:2, T:2]

a) the vertex

b) the maximum or minimum value and why it's a max or a min.

c) The zeros of the quadratic (if it has any)

11. A ball is thrown from the roof of the school. The height of the ball is given by the function $h(t) = -5t^2 + 10t + 10.2$, where $h(t)$ is the height in metres and t is the time in seconds. Round your answers to two decimal places.

a) What is the height of the ball before it is thrown? [A: 1]

b) What is the maximum height of the ball and when does it reach it? (*hint – AoS*) [A: 3]

c) How long will it take for the ball to reach the ground? [A:2]

12. Simplify fully the radical expression: [T:3]

$$-5\sqrt{20} + 2\sqrt{45} + 3\sqrt{24}$$

13. The growth in population of a bacteria culture is given by the function $P(t) = 2500(1.09)^t$ where t is in hours. Determine:

a) The initial population at the beginning of bacteria. [K:1]

b) The growth rate of the culture [K:1]

c) The expected population of the culture after 24 hours [A:1]

d) Approximate how long it will take for the bacteria population to be doubled. [A:2]

14. Given the function: $f(x) = -\cos(2x - 120)^o + 1$, identify the period, amplitude and domain and range for the two cycles of the sinusoidal function. [K:4]

Period = _____

Amplitude = _____

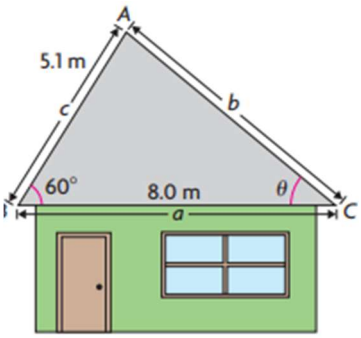
Central Axis = _____

Phase Shift = _____

15. a) For the angle $\theta = 225°$, draw it in standard position and determine the related acute angle. Determine the exact value of sin(225°). Draw a sketch [T:4]

b) Find both angles for $\cos\theta = -0.456$ between 0 and 360 degrees (draw a diagram). [T:3]

16. Mitchell wants his 8.0 wide house to be heated with a solar hot-water system. In order for the system to be effective, the system must be installed on the south side of the roof (the 5.1m side in the diagram) and the roof needs to be inclined by $60°$. If the angle, θ on the north side of the roof is inclined more than $40°$ then the roof will be too steep for Mitchell to install the system himself. Will Mitchell be able to install this system by himself? [A:4]



17. Prove $\frac{1}{\cos\theta} - (\tan\theta)(\sin\theta) = \cos\theta$. [C:4]

18. If the 12th term of an arithmetic sequence is 25 and the first term is 3, determine t_{300}. [A:3]

19. Determine the recursive and the general formula for the geometric sequence.
Determine t_{12} and S_{12} [A:4]

-2, 8, -32, …

20. Frank has $35,000 he wishes to invest. He finds a GIC which pays interest at a rate of 2.4%/a compounded quarterly. How much will his account be worth after 25 years, ***and*** how much interest did he earn? [A:3]

21. Julie decides to save $1500 every month. For the next 25 years Julie deposits $1500 every month in an account which pays 1.8%/a compounded monthly. At the end of the 25 years Julie stops saving the monthly $1500 and decides to move her savings (as a lump sum) into an account which pays 2.0% compounded quarterly. She leaves her savings in the new account for 10 years. How much money has Julie managed to save in 35 years? [A:4]

Folks – thanks for a good semester. Remember that God's love for you is bigger than infinity. Blessings to each one of you.