

TORONTO DISTRICT CHRISTIAN HIGH SCHOOL

FINAL EXAM

MATH 11 UNIVERSITY (MCR3U)

Jun 22, 2023

Name: _____

2 hours

Teacher: J. Templeton

	<i>Mark Breakdown:</i>
Knowledge and Understanding	21
Thinking	22
Communication (<i>including 4 for presentation</i>)	10
Application	<u>27</u>
Total:	80

Notes:

You must stay for the entire time.

You may use a ruler and/or a calculator.

Multiple Choice

K ___/7

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

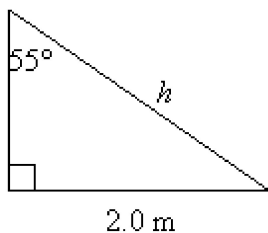
- ___ 1. Which relation is a function?
- a. $\{(-3, -2), (-1, 3), (0, -2), (3, 4)\}$ c. $\{(-7, -7), (-2, 5), (-1, 6), (-2, -5)\}$
b. $\{(0, 1), (3, 2), (5, -3), (0, 2)\}$ d. $\{(-4, -7), (-9, 5), (4, -2), (-9, 0)\}$

- ___ 2. Evaluate $f(x) = -4x^2 + 7$ for $f(1) + f(-2)$.
- a. -6 c. 26
b. 3 d. 94

- ___ 3. Which of the following expresses $\sqrt{96}$ in simplest form?
- a. $6\sqrt{3}$ c. $4\sqrt{6}$
b. $16\sqrt{6}$ d. $8\sqrt{2}$

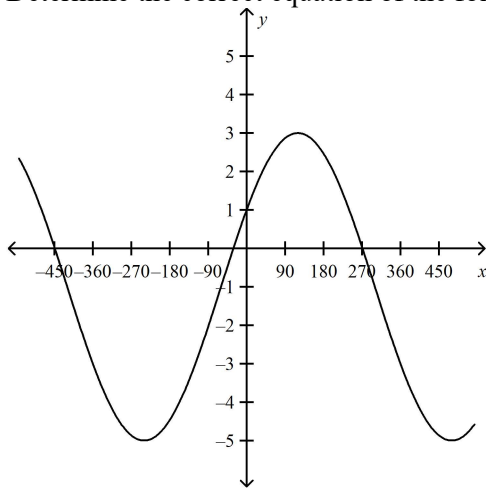
- ___ 4. Which of the following is equivalent to the expression $(a^3 b^4)^{-2} (a^{-3} b^{-5})^{-4}$?
- a. $a^6 b^{12}$ c. $\frac{1}{a^6 b^{12}}$
b. $a^{12} b^{15}$ d. $\frac{1}{a^6 b^7}$

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



- a. 3.1 m c. 2.1 m
b. 2.4 m d. 2.9 m
- ___ 6. Without graphing, determine the period of the function $y = 3.7 \sin(15x) - 0.1$.
- a. 24 c. 30
b. 15 d. 3.7

7. Determine the correct equation of the following graph.



a. $y = 4 \cos(2x - 60^\circ) - 1$

b. $y = 4 \cos(0.5x - 60^\circ) - 1$

c. $y = 4 \cos(2x + 30^\circ) - 1$

d. $y = 4 \cos(0.5x + 30^\circ) - 1$

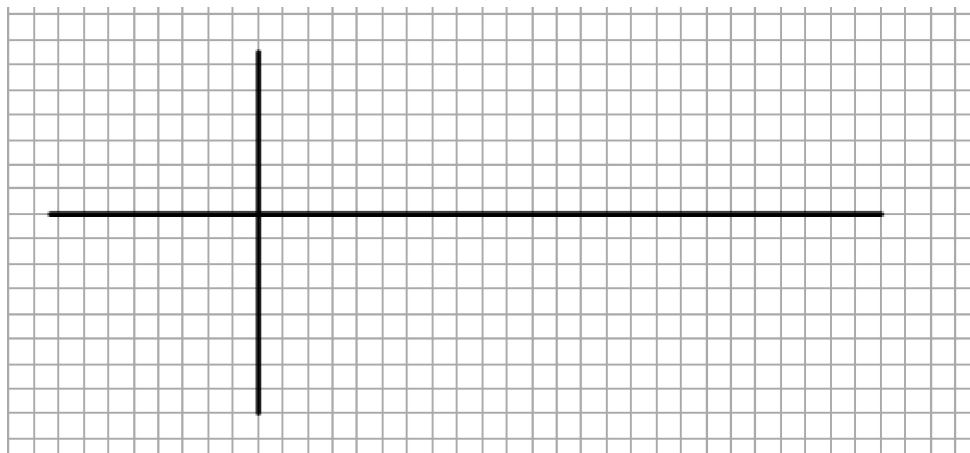
Full Solution - Note- there are upto 4 Communication points available for presentation of your mathematics.

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) $\frac{x^2-7x-3}{x^2-12x+20} \div \frac{6x^2+18x}{6x^3-12x^2}$

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

Period = _____

Amplitude = _____

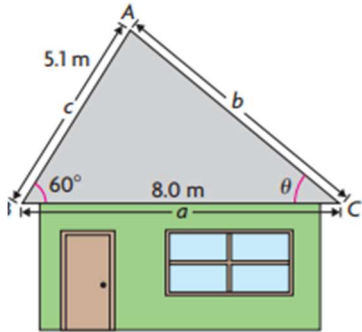
Central Axis = _____

Phase Shift = _____

15. a) For the angle $\theta = 225^\circ$, draw it in standard position and determine the related acute angle. Determine the exact value of $\sin(225^\circ)$. 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 5.1 m 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 $\frac{1}{\cos} - (\tan\theta)(\sin\theta) = \cos\theta$. [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 – have a wonderful summer. Thanks for a good semester. Remember that God’s love for you is bigger than infinity. Blessings to each one of you.