Discuss 2-part Summative

Entertainment pp. 360-362 #1, 3, 5, 7, 8, 10*, 11%, 13

*Answers in the text are incorrect. Change them to:

10a) $n(t) = 3.7\cos(\frac{2\pi}{365}(t-172)) + 12$

10b) 9.2 hours

Also, for #10a change the instruction from "*n*th" day to "*t*-th day"

% remember Example 2? Also, the answer for 11 is incorrect.
The "d" value is not 116; it is approx. 102

Entertainment IS YOUR CALCULATOR IN RADIAN MODE?

#1 to 4, 5b, 6, 8, 11d, 12, 13, 14, 16&, 19*

&: for 16, a *d*-value of about 0.3 is acceptable

* for 19d, sub in $h = \pm 0.01$ immediately

Note final answer corrections:

#6 a) $\tan\theta = \pm\frac{12}{5}$

#6 c) $\theta = 2.0\, or\, 4.3$

#19d) approx. -144

IS YOUR CALCULATOR IN RADIAN MODE?

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Note: do not use a calculator for #2.

In #6 answers may vary.

For #8a, use only a cosine function.

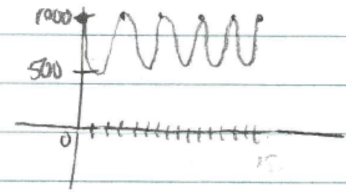
Note final answer corrections:

#1: y = tan x is <u>also</u> a function that is possible!

#3: y = 94.9

p. 361 **7.** 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 500 Hz, and the maximum frequency was 1000 Hz. The maximum frequency occurred at $t = 0$ and $t = 15$. The person also reported that, in 15, she heard the maximum frequency 6 times (including the times at $t = 0$ and $t = 15$). What is the equation of the cosine function that describes the frequency of this siren?

7 min 500 Hz
max 1000 Hz at $t=0$ & $t=15$
↳ 6 times from 0 to 15 inclusive
Find cosine eq'n.



5 complete cycles in 15 sec.
$\therefore$ 1 cycle = 3 sec

$a = \frac{1000-500}{2} = \frac{500}{2} = \cancel{225} = 250$ $\quad k = \frac{2\pi}{3}$ $\quad c = \frac{1000+500}{2} = 750$ $\quad d = 0$

$\therefore y = \cancel{225}\,250 \cos\left(\frac{2\pi}{3} t\right) + 750$

p. 361

8. A contestant on a game show spins a wheel that is located on a plane perpendicular to the floor. He grabs the only red peg on the circumference of the wheel, which is 1.5 m above the floor, and pushes it downward. The red peg reaches a minimum height of 0.25 m above the floor and a maximum height of 2.75 m above the floor. Sketch two cycles of the graph that represents the height of the red peg above the floor, as a function of the total distance it moved. Then determine the equation of the sine function that describes the graph.

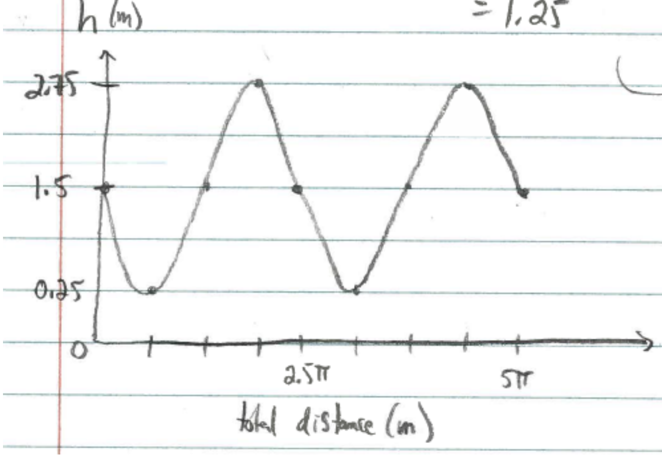
8. Wheel max 2.75 m
min 0.25 m
start at 1.5 m

$a = \frac{2.75 - 0.25}{2} = \frac{2.5}{2} = 1.25$

$c = \frac{2.75 + 0.25}{2} = \frac{3}{2} = 1.5$

$d = 0$; k: $C = 2\pi r = 2\pi(1.25) = 2.5\pi$

$\therefore k = \frac{2\pi}{2.5\pi} = \frac{20}{25} = \frac{4}{5}$



$y = -1.25 \sin\left(\frac{4}{5}x\right) + 1.5$

p. 362 **11.** The city of Thunder Bay, Ontario, has average monthly temperatures that vary between $-14.8\,°C$ and $17.6\,°C$. The following table gives the average monthly temperatures, averaged over many years. Determine the equation of the sine function that describes the data, and use your equation to determine the times that the temperature is below $0\,°C$.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Average Temperature (°C)	−14.8	−12.7	−5.9	2.5	8.7	13.9	17.6	16.5	11.2	5.6	−2.7	−11.1

11. Using the table
max = 17.6
min = −14.8

$\therefore a = \frac{17.6-(-14.8)}{2} = \frac{32.4}{2} = 16.2$

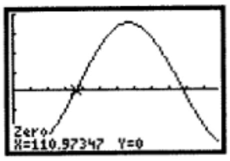
$c = \frac{17.6+(-14.8)}{2} = \frac{2.8}{2} = 1.4$

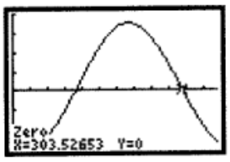
$k = \frac{2\pi}{365}$ Z days to repeat

$d = 0$ for cos but it says use sine f(x)?

$$T(t) = 16.2\sin\left(\frac{2\pi}{365}(t-116)\right) + 1.4$$

Graph the equation on a graphing calculator to determine when the temperature is below 0 °C.





$0 < t < 111$ and $304 < t < 365$

$T(t) < 0$

$16.2\sin\left(\frac{2\pi}{365}(t-116)\right)+1.4<0$

Find zeros:

$16.2\sin\left(\frac{2\pi}{365}\right)(t-116) = -1.4$

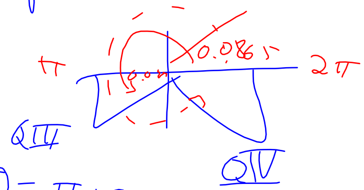
$\sin\left(\frac{2\pi}{365}(t-116)\right) = \frac{-1.4}{16.2}$

$\frac{2\pi}{365}(t-116) = \sin^{-1}\left(\frac{-1.4}{16.2}\right)$

$t = \frac{365}{2\pi}\left(\sin^{-1}\left(\frac{-1.4}{16.2}\right)\right) + 116$

$\beta = \sin^{-1}\left(\frac{+1.4}{16.2}\right)$

$\beta = 0.0865$



$\theta = \pi + \beta$ $\doteq 3.228$

$\theta = 2\pi - \beta$ $\doteq 6.196$

$t_2 = \frac{365}{2\pi}(6.196) + 116$

$\doteq 475.93$

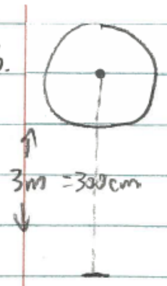
Note: for t_2: 475.93 − 365 $\doteq 110.9$

$t_1 = \frac{365}{2\pi}(3.228) + 116$

$\doteq 303.5$

p. 362 **13.** A clock is hanging on a wall, with the centre of the clock 3 m above the floor. Both the minute hand and the second hand are 15 cm long. The hour hand is 8 cm long. For each hand, determine the equation of the cosine function that describes the distance of the tip of the hand above the floor as a function of time. Assume that the time, t, is in minutes and that the distance, $D(t)$, is in centimetres. Also assume that $t = 0$ is midnight.

13.



↑15cm vs ↑8cm

Minute Hand

Max 315 cm

min 285 cm

$a = \frac{315-285}{2}$

$= 15$

$c = 300$

$d = 0$

$k = \frac{2\pi}{60 \text{ min}}$

$= \frac{\pi}{30 \text{ min}}$

$\therefore D(t) = 15\cos\left(\frac{\pi}{30}t\right) + 300$

Second

$k = \frac{2\pi}{1 \text{ min}}$

$= 2\pi$

$\therefore D(t) = 15\cos(2\pi t) + 300$

Hour

max = 308 $\therefore a = 8$

min = 292

$k = \frac{2\pi}{720}$

$= \frac{\pi}{360}$

60 min × 12 hrs = 720

$\therefore D(t) = 8\cos\left(\frac{\pi}{360}t\right) + 300$