MATH 12
TRIG PROBLEM SET

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FINAL SCORE: 25/25

BE SURE TO SHOW ALL YOUR WORK
UNLESS OTHERWISE STATED, FINAL ANSWERS MUST BE EXACT (NO DECIMALS) AND IN LOWEST TERMS

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1. Convert the following angles from one mode to the other. (2 marks)

a) Convert 204° to radians.

$204^\circ \times \frac{\pi}{180^\circ} = \boxed{\frac{17\pi}{15}}$

b) Convert $-\frac{43\pi}{20}$ to degrees.

$-\frac{43\pi}{20} \times \frac{180}{\pi} = \boxed{-387^\circ}$

2. Rounded to the nearest hundredth, find the ratio for each trigonometric expression. (2 marks)

a) $\tan(-57^\circ)$

$= \boxed{-1.54}$

b) $\sec 2.28$

$= \frac{1}{\cos 2.28} = \boxed{-1.54}$

3. Find the exact ratio of each trigonometric expression. (2 marks)

a) $\tan\left(\frac{\pi}{6}\right)$

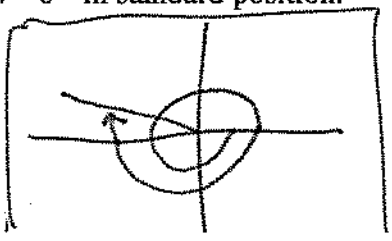
$= \boxed{\frac{1}{\sqrt{3}}} = \frac{\sqrt{3}}{3}$

b) $\frac{\csc\left(-\frac{4\pi}{3}\right)}{\frac{1}{\sin\left(-\frac{4\pi}{3}\right)}} = \frac{1}{\frac{\sqrt{3}}{2}} = \boxed{\frac{2}{\sqrt{3}}} = \frac{2\sqrt{3}}{3}$

ref $\angle = \frac{\pi}{3}$ in quad. 2

4. Use the standard angle $\theta = -\frac{19\pi}{6}$ to answer the following questions. (2 marks)

a) Draw θ in standard position.



b) What is the reference angle for θ?

ref $\angle = \boxed{\frac{\pi}{6}}$

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5. If the point $P(1,-5)$ (x, y) is on the terminal arm of the standard angle θ, what is the exact ratio for $\sec\theta$? (2 marks)

$\cos\theta = \frac{x}{r}$ $\quad r^2 = (1)^2 + (-5)^2$

$\cos\theta = \frac{1}{\sqrt{26}}$ $\quad r = \sqrt{26}$

$\sec\theta = \frac{1}{\cos\theta} = \frac{1}{\frac{1}{\sqrt{26}}} = \boxed{\sqrt{26}}$

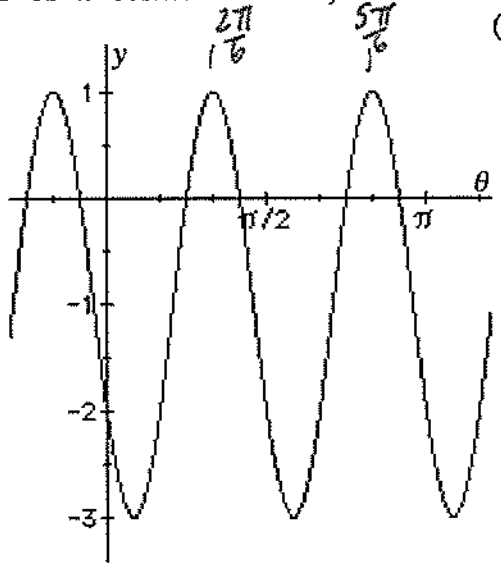
6. If $\tan\theta = \sqrt{3}$ and the value of $\sin\theta$ is negative, then what is the exact radian value of the angle θ ? (2 marks)

$\tan\theta = \frac{y}{x} = \frac{\sqrt{3}}{1}$ & $\tan\theta$ is +ive.

$\theta = \frac{\pi}{3}$ radians but, if $\sin\theta$ is negative the angle must be in quadrant 3 so ∴

$\theta = \boxed{\frac{4\pi}{3}}$

7. Given that the graph shown below is the graph of a *cosine* function, find the following information. (2 marks)



a) Amplitude:

$\frac{\text{max}-\text{min}}{2} = \frac{1-(-3)}{2} = \boxed{2}$

b) Period Length: $\boxed{\frac{\pi}{2}}$

c) Vertical displacement:

$\frac{1+(-3)}{2} = \boxed{-1}$

d) phase shift: $-\frac{\pi}{6}$

$\boxed{\text{left } \frac{\pi}{6}}$

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8. Write the equation of a *sine* function with the following properties: (2 marks)

- **Max. Value:** 2
- **Min. Value:** -6
- **Period Length:** 10π
- **Phase shift:** $-\frac{\pi}{4}$

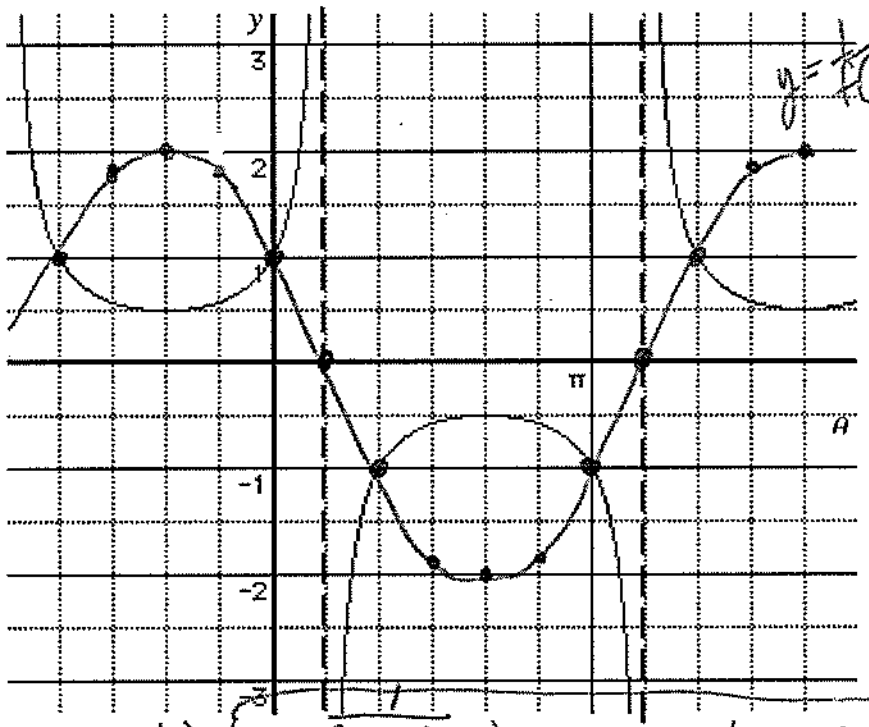
amplitude $= \frac{\text{max}-\text{min}}{2} = \frac{2-(-6)}{2} = 4$

$b = \frac{2\pi}{p} = \frac{2\pi}{10\pi} = \frac{1}{5}$

vertical displacement $= \frac{\text{max}+\text{min}}{2} = \frac{2+(-6)}{2} = -2$

$y = 4\sin\frac{1}{5}\left(x+\frac{\pi}{4}\right)-2$

9. Use the graph of $y = f(\theta)$ shown on the grid to the right to answer the following questions. (4 marks)



a) On the same grid, sketch the graph of $y = \frac{1}{f(\theta)}$. Be as accurate as possible.

b) If $y = f(\theta)$ is a *secant* function, then what is the *actual* equation of the *original* graph.

a.) $f(1)$ & $f(-1)$ remain the same
asymptotes become zeros
& zeros become asymptotes.
all other pts $(x,y) \to (x, \frac{1}{y})$

b.) $y = 2\cos(\theta+\frac{\pi}{3})$ OR $y = \frac{1}{2}\sec(\theta+\frac{\pi}{3})$

10. To the nearest degree, what is the measure of the sector angle whose arc is 24 cm if the diameter of the circle is 17 cm ? (2 marks)

$C = \pi d$
$= \pi(17)$
$= 53.38\text{cm}$

$\frac{24\text{cm}}{53.38\text{cm}} = \frac{x}{360°}$

$x = 162°$

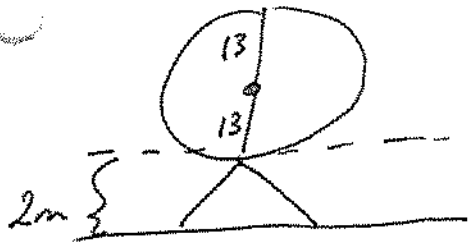
11. A giant Ferris Wheel has a radius of 13 m and takes ten minutes to complete three full revolutions. Britney boards the Ferris wheel at its lowest point which is 2 m above the ground. (3 marks)

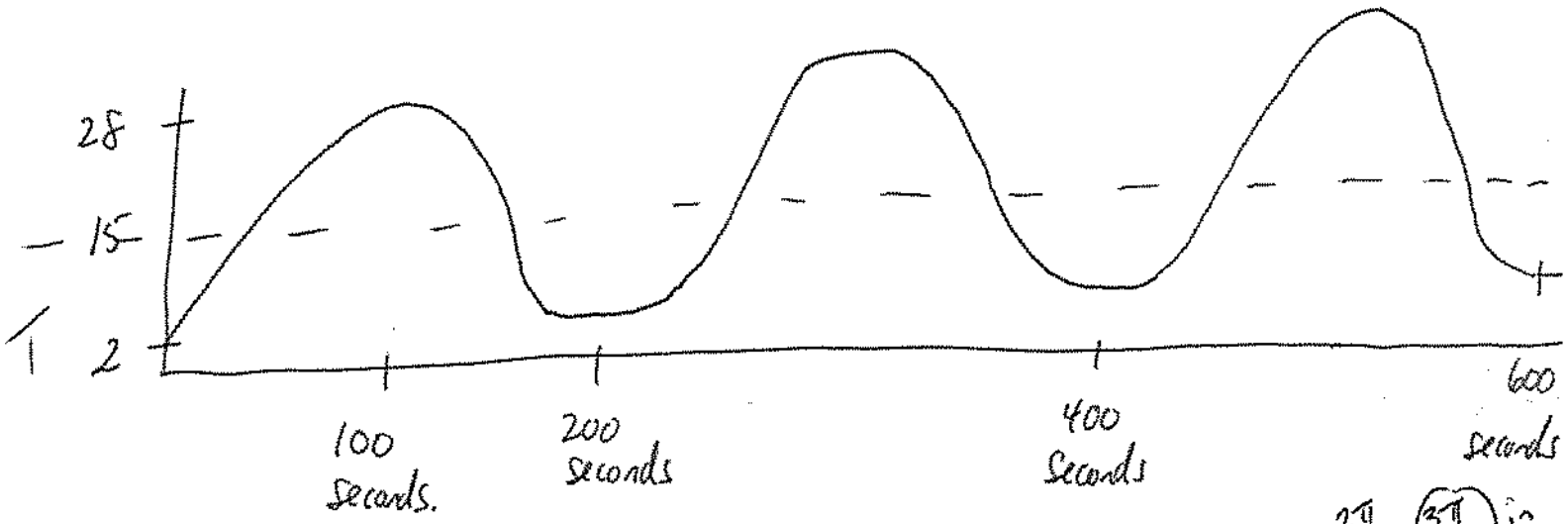
a) If $h(t)$ represents the height of Britney above the ground t seconds after the ride begins, what sinusoidal equation can be used to model her ride on the Ferris Wheel?

* See next page for Solution *

If the total ride takes 16 min and 40 sec to complete, how many times during the ride will Britney be exactly 20 m above the ground?

height ranges from 28m (max) to 2m (min)





amplitude $= \frac{28-2}{2} = 13$

period = 200 seconds

phase shift = 100 for cosine

vertical displacement $= \frac{28+2}{2} = 15$

equation →

$y = 13 \cos \frac{2\pi}{200}(t-100) + 15$

or $\frac{2\pi}{\frac{10}{3}} = \frac{3\pi}{5}$ in min

$y = 13 \cos \frac{\pi(t-100)}{100} + 15$

or if $\sin(t-50)$

or $-13\cos 2\pi(\frac{1}{2}) + 1$

# of times at 20m during 16 minute & 40 second ride:

period = 200 seconds ride duration = 1000 seconds

$\frac{1000 \text{ seconds}}{200 \text{ seconds}} = 5$ cycles.

during each cycle there are 2 points where 20m is reached. ∴ 10 times

NA