Sinusoidal models in radians: tides and Ferris wheels worksheet – Grade 12

Grade 12 · Mixed level · 20 questions · **Version X8882**

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1. A Ferris wheel turns 2 times every minute. What is the period of the rider's height, in seconds?

   Answer: _____ s

2. A Ferris wheel turns 4 times every 2 minutes. What is the period of the rider's height, in seconds?

   Answer: _____ s

3. A Ferris wheel has a radius of 8 m. Riders get on at the lowest point, 4 m above the ground. How high is the centre of the wheel? (m)

   Answer: _____ m

4. The depth of water at a harbour is $h = 4\sin\left(\frac{\pi}{6}(t-5)\right) + 8$ metres, t hours after midnight. What is the period, in hours?

   Answer: _____ hours

5. A Ferris wheel has a diameter of 50 m. Riders get on at the lowest point, 1 m above the ground. How high is the top of the wheel? (m)

   Answer: _____ m

6. A Ferris wheel has a radius of 10 m. Riders get on at the lowest point, 1 m above the ground. How high is the centre of the wheel? (m)

   Answer: _____ m

7. The depth of water at a harbour is $h = 1.8\sin\left(\frac{\pi}{5}(t-4)\right) + 6$ metres, t hours after midnight. What is the period, in hours?

   Answer: _____ hours

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8. A Ferris wheel of radius 17 m turns once every 72 s. Riders get on at the lowest point, 6 m above the ground. Which equation gives a rider's height h metres after t seconds?

   A. $h(t) = -17\cos\left(\frac{\pi}{72}t\right) + 23$ **B.** $h(t) = -17\cos\left(\frac{\pi}{36}t\right) + 17$

   C. $h(t) = -17\cos\left(\frac{\pi}{36}t\right) + 23$ **D.** $h(t) = 17\cos\left(\frac{\pi}{36}t\right) + 23$

9. The depth of water at a harbour is $h = 1.5\sin\left(\frac{\pi}{6}(t-4)\right) + 6$ metres, t hours after midnight. At what times between midnight and midnight is the water deepest, and how deep is it then?

   A. 7:00 a.m. and 7:00 p.m., 6 m **B.** 4:00 a.m. and 4:00 p.m., 7.5 m

   C. 1:00 a.m. and 1:00 p.m., 7.5 m **D.** 7:00 a.m. and 7:00 p.m., 7.5 m

10. The depth of water at a harbour is $h = 2.5\sin\left(\frac{\pi}{5}(t-4)\right) + 5$ metres, t hours after midnight. At what times between midnight and midnight is the water deepest, and how deep is it then?

    A. 1:30 a.m. and 11:30 a.m. and 9:30 p.m., 7.5 m **B.** 6:30 a.m. and 4:30 p.m., 5 m

    C. 6:30 a.m. and 4:30 p.m., 7.5 m **D.** 4:00 a.m. and 2:00 p.m., 7.5 m

11. A Ferris wheel of radius 18 m turns once every 120 s. Riders get on at the lowest point, 3 m above the ground. Which equation gives a rider's height h metres after t seconds?

    A. $h(t) = -18\cos\left(\frac{\pi}{120}t\right) + 21$ **B.** $h(t) = -18\cos\left(\frac{\pi}{60}t\right) + 18$

    C. $h(t) = -18\cos\left(\frac{\pi}{60}t\right) + 21$ **D.** $h(t) = 18\cos\left(\frac{\pi}{60}t\right) + 21$

12. A Ferris wheel of radius 15 m turns once every 30 s. Riders get on at the bottom, 6 m above the ground, so $h(t) = -15\cos\left(\frac{\pi}{15}t\right) + 21$. How high is a rider after 6 s? (m, to one decimal place)

    Answer: _____ m

13. The depth of water at a harbour is $h = 3\sin\left(\frac{\pi}{7}(t-3)\right) + 4$ metres, t hours after midnight. What is the depth at 3:00 p.m.? (m, to one decimal place)

    Answer: _____ m

14. A Ferris wheel of radius 21 m turns once every 80 s. Riders get on at the lowest point, 4 m above the ground. Which equation gives a rider's height h metres after t seconds?

    A. $h(t) = -21\cos\left(\frac{\pi}{40}t\right) + 21$ **B.** $h(t) = -21\cos\left(\frac{\pi}{40}t\right) + 25$

    C. $h(t) = 21\cos\left(\frac{\pi}{40}t\right) + 25$ **D.** $h(t) = -21\cos\left(\frac{\pi}{80}t\right) + 25$

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15. A Ferris wheel with a diameter of 40 m turns 2 times every 2 minutes. Riders get on at the lowest point, 2 m above the ground. What is the exact height of a rider 55 s after getting on? (m)

A. $22 - 10\sqrt{2}$ **B.** $22 + 10\sqrt{3}$ **C.** 32 **D.** $22 - 10\sqrt{3}$

16. A Ferris wheel of radius 12 m turns once every 48 s. Riders get on at the bottom, 5 m above the ground, so h(t) = −12 cos(π/24 t) + 17. During the first rotation, when is a rider 11 m or less above the ground?

A. 0 ≤ t ≤ 8 s and 40 s ≤ t ≤ 48 s **B.** 8 s ≤ t ≤ 40 s **C.** 0 ≤ t ≤ 4 s and 44 s ≤ t ≤ 48 s **D.** 0 ≤ t ≤ 16 s and 32 s ≤ t ≤ 48 s

17. For $d = 4\sin\left(\frac{\pi}{10}(t-4)\right) + 4$, find every value of t in the cycle $4 \le t \le 24$ where d = 8. Give exact answers.

A. t = 1 **B.** t = 19 **C.** t = 9 **D.** t = 5

18. The graph of $y = 4\sin(\theta - p)$ passes through the point $\left(\frac{\pi}{6},\ 2\sqrt{3}\right)$. Which is a possible value of p, with $0 \le p < 2\pi$?

A. $\frac{5\pi}{3}$ **B.** $\frac{\pi}{6}$ **C.** $\frac{11\pi}{6}$ **D.** $\frac{\pi}{2}$

19. The point $A\left(k,\ -\frac{\sqrt{3}}{2}\right)$ is on the graph of $y = \cos 4\theta$. Which is a possible value of k?

A. $\frac{\pi}{24}$ **B.** $\frac{5\pi}{24}$ **C.** $\frac{10\pi}{3}$ **D.** $\frac{5\pi}{6}$

20. The graph of $y = 6\sin(\theta - p)$ passes through the point $\left(\frac{\pi}{2},\ -3\right)$. Which is a possible value of p, with $0 \le p < 2\pi$?

A. $\frac{4\pi}{3}$ **B.** $\frac{5\pi}{3}$ **C.** $\frac{\pi}{3}$ **D.** $\frac{5\pi}{6}$

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Answer key · Version X8882

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1. **30**
2. **30**
3. **12**
4. **12**
5. **51**
6. **11**
7. **10**
8. **C (**$h(t) = -17\cos\left(\frac{\pi}{36}t\right) + 23$**)**
9. **D (7:00 a.m. and 7:00 p.m., 7.5 m)**
10. **C (6:30 a.m. and 4:30 p.m., 7.5 m)**
11. **C (**$h(t) = -18\cos\left(\frac{\pi}{60}t\right) + 21$**)**
12. **16.4**
13. **1.7**
14. **B (**$h(t) = -21\cos\left(\frac{\pi}{40}t\right) + 25$**)**
15. **D (**$22 - 10\sqrt{3}$**)**
16. **A (0 ≤ t ≤ 8 s and 40 s ≤ t ≤ 48 s)**
17. **C (t = 9)**
18. **C (**$\frac{11\pi}{6}$**)**
19. **B (**$\frac{5\pi}{24}$**)**
20. **A (**$\frac{4\pi}{3}$**)**

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