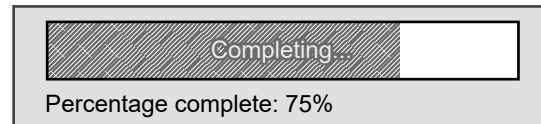


Question 11

(15 marks)

Progress bars show computer users the 'percentage complete' of a task. Research has indicated that a user's perceived completion time can be affected by changes in the speed of a progress bar during the completion of a task.



To investigate perceived completion time, researchers create two 30-second tasks. The progress bar for each task accurately displays the completion of the task from 0% to 100% during the 30 seconds.

- (a) Task A completes at an increasing rate, resulting in a progress bar that speeds up during the 30 seconds.

The researchers predict that the mean perceived completion time for Task A will be shorter than the actual completion time (30 seconds).

To test this prediction, 100 users were shown the progress bar for Task A and their perceived completion time, x_A , was recorded. For the sample of 100 users, the mean perceived completion time for Task A was $\bar{x}_A = 29.2$ seconds.

- (i) Calculate a 95% confidence interval for the mean perceived completion time, μ_A , for Task A. Assume the population standard deviation was $\sigma_A = 7.6$ seconds.

(2 marks)

- (ii) Can the researchers' prediction be supported with 95% confidence? Justify your answer.

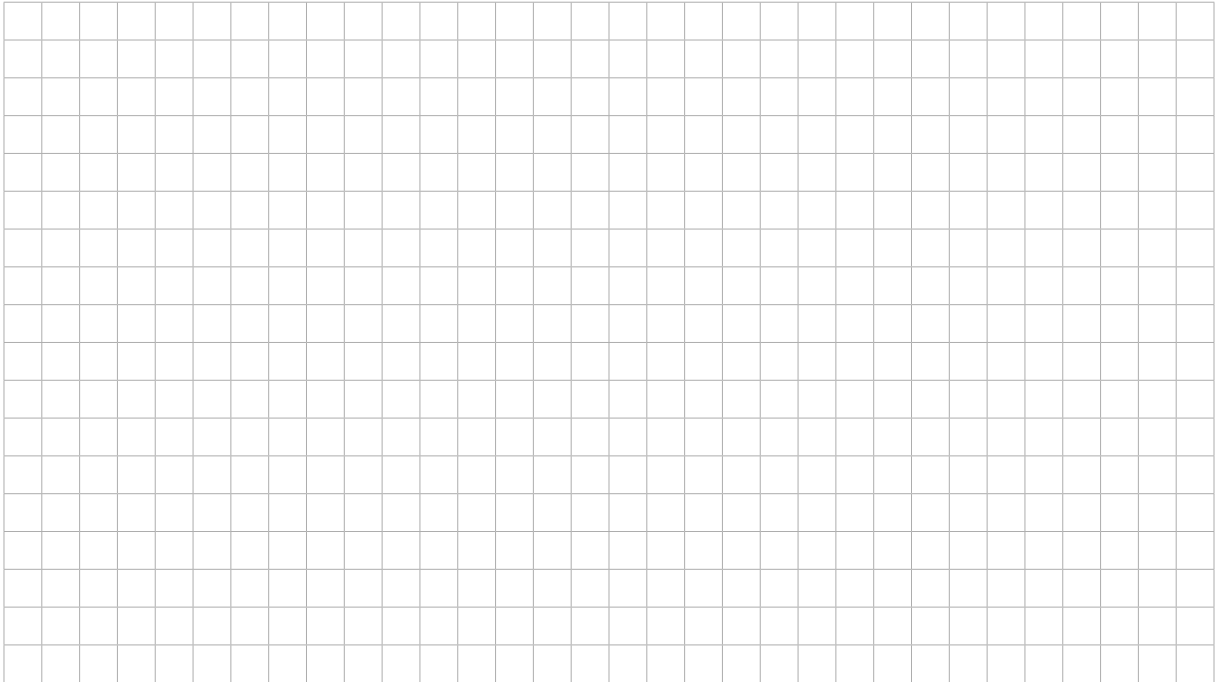
(2 marks)

- (d) The speed of the progress bar (the rate of change of the percentage complete) for Task B was created using the function

$$T_B'(t) = a \cos(bt) + a \text{ for } 0 \leq t \leq 30,$$

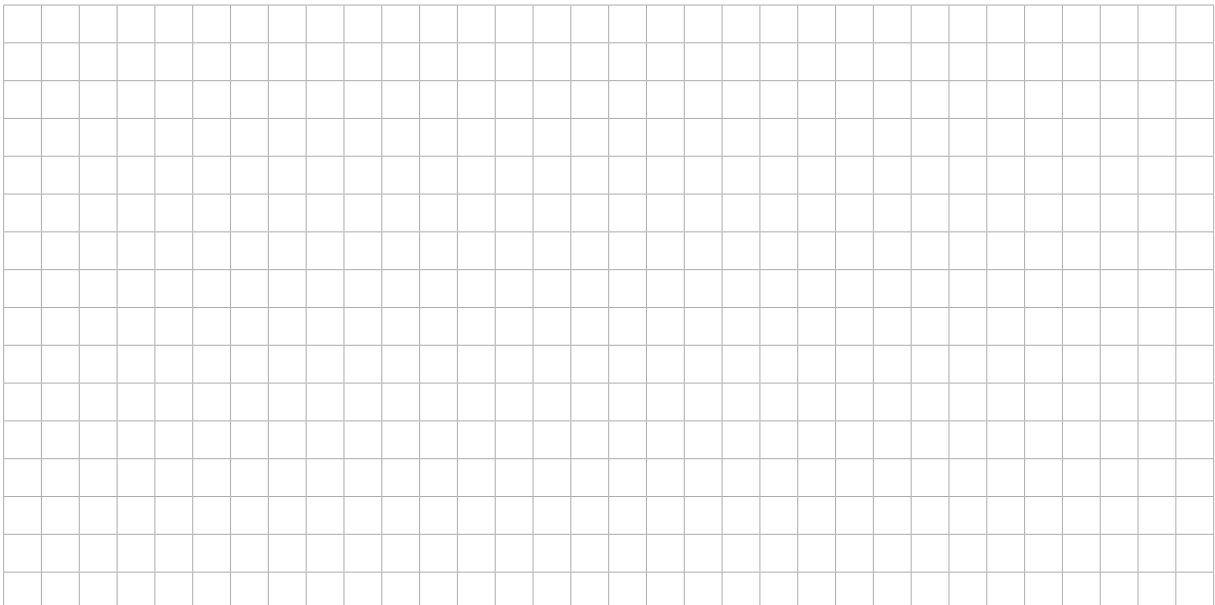
where a and b are positive constants, and t is the number of seconds since the beginning of the task.

- (i) Given that Task B pauses only once at $t=24$ seconds, show that the *only* possible value for b is $\frac{\pi}{24}$.



(4 marks)

- (ii) Hence, given that Task B is completed in 30 seconds, determine the *exact* value of a .



(3 marks)