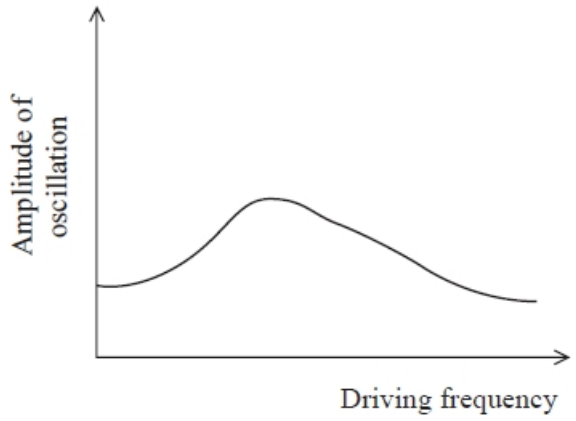
Oscillations (MCQ Only)

Q1.

A damped mass-spring system is driven into oscillation. The graph shows the amplitude of oscillation as the driving frequency is varied.



The damping is decreased.

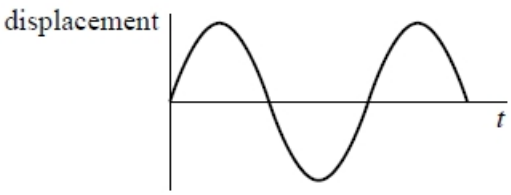
Which row of the table describes what happens to the maximum amplitude of oscillation and the driving frequency at which this occurs?

	Maximum amplitude	Frequency at which maximum amplitude occurs
☒ **A**	decreases	decreases
☒ **B**	decreases	increases
☒ **C**	increases	decreases
☒ **D**	increases	increases

(Total for question = 1 mark)

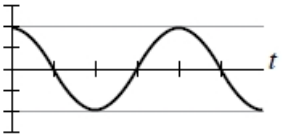
Q2.

The graph shows the variation of displacement with time for a particle undergoing simple harmonic motion.

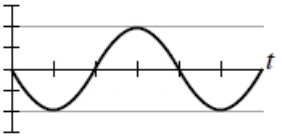


Select the graph that correctly shows the variation of velocity with time for the particle.

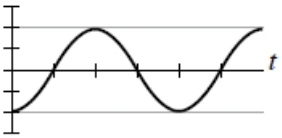
☒ **A**



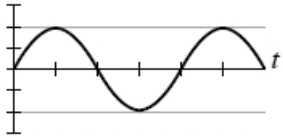
☒ **B**



☒ **C**



☒ **D**



(Total for question = 1 mark)

Q3.

A pendulum of length *l* with a bob of mass *m* oscillates with frequency *f*.

What is the frequency of a pendulum of length 4*l* with a bob of mass 2*m*?

- ☒ **A** $4f$
- ☒ **B** $2f$
- ☒ **C** f
- ☒ **D** $\frac{f}{2}$

(Total for question = 1 mark)

Q4.

A playground swing completes 24 oscillations in 1 minute.

Which of the following is the frequency of the oscillations?

(1)

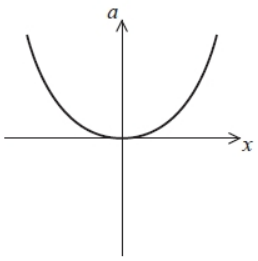
- ☒ **A** 0.042 Hz
- ☒ **B** 0.40 Hz
- ☒ **C** 2.5 Hz
- ☒ **D** 24 Hz

(Total for question = 1 mark)

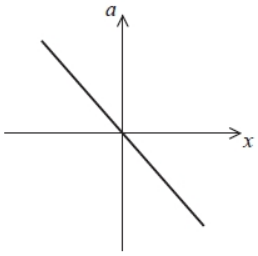
Q5.

Which of the following graphs correctly shows the relationship between acceleration *a* and displacement *x* for a simple harmonic oscillator?

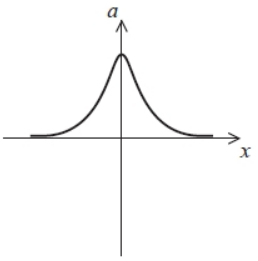
A



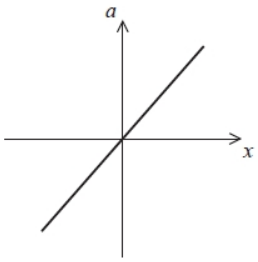
B



C



D



☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q6.

A pendulum of length *l* oscillates with a frequency *f*. The length of the pendulum is doubled.

The frequency of oscillation will be

☒ **A** $\frac{f}{\sqrt{2}}$

☒ **B** $\frac{f}{2}$

☒ **C** $\sqrt{2}f$

☒ **D** $2f$

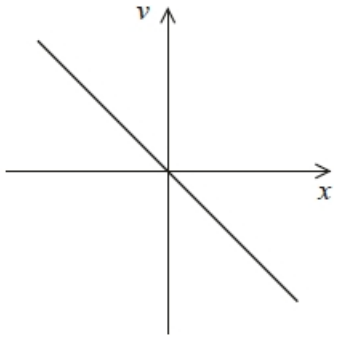
(Total for question = 1 mark)

Q7.

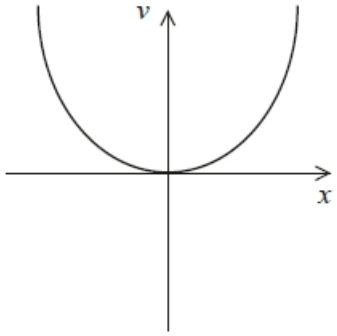
A mass at the end of a spring is set into small amplitude simple harmonic motion.

Which of the following graphs correctly shows the variation of velocity *v* of the mass with displacement *x* for one complete oscillation?

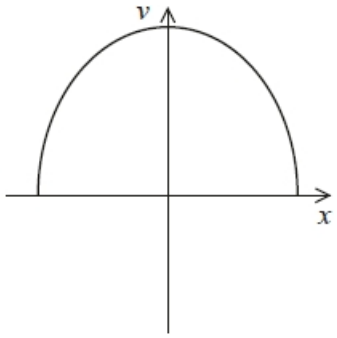
☒ **A**



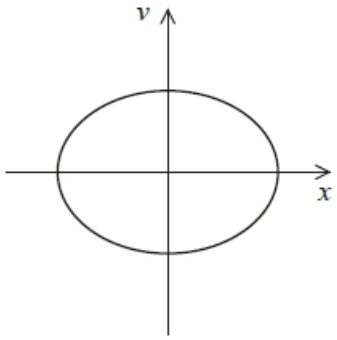
☒ **B**



☒ **C**



☒ **D**



(Total for question = 1 mark)

Q8.

The Millennium Bridge is a pedestrian suspension bridge across the River Thames in London. The bridge had to be closed soon after its opening because of a large swaying motion created by people walking across it. A damping mechanism was installed to fix the problem.

The damping mechanism

☒ **A** increased the stiffness of the bridge.

☒ **B** increased the natural frequency of the bridge.

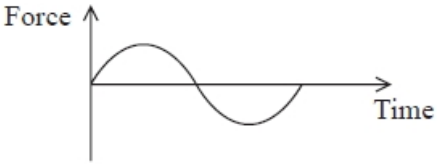
☒ **C** dissipated energy from the bridge.

☒ **D** decreased the forcing frequency on the bridge.

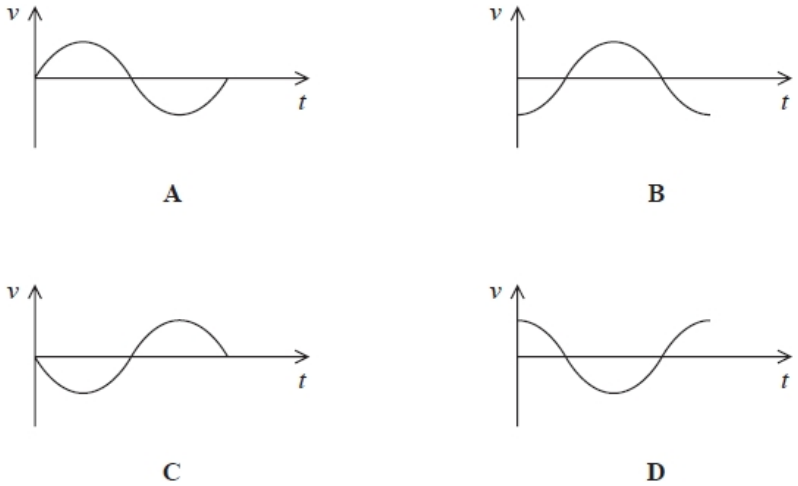
(Total for question = 1 mark)

Q9.

A mass is suspended from a spring and allowed to come to equilibrium.
The mass is displaced vertically and moves with simple harmonic motion.
The graph shows how the resultant force on the mass varies with time.



Which of the following graphs shows how the velocity *v* of the mass varies with time *t* over the same time interval?



☒ **A**

☒ **B**

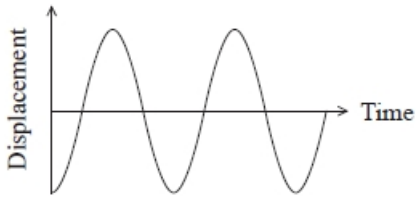
☒ **C**

☒ **D**

(Total for question = 1 mark)

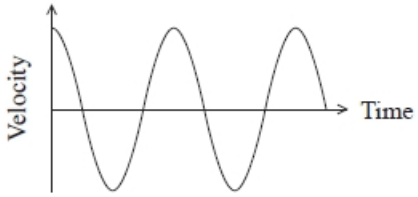
Q10.

The graph shows how the displacement of a simple harmonic oscillator varies with time.

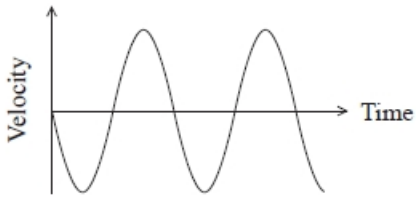


Which of the following graphs shows how velocity varies with time for the same oscillator, over the same time period?

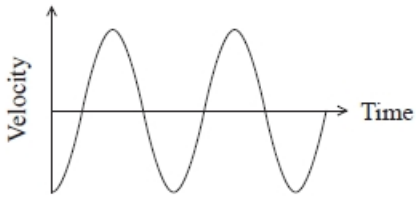
☒ **A**



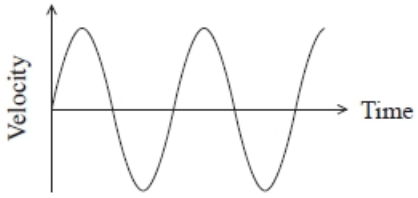
☒ **B**



☒ **C**



☒ **D**



(Total for question = 1 mark)

Mark Scheme - Oscillations (MCQ Only)

Q1.

Question Number	Acceptable answer	Additional guidance	Mark
	D	The only correct answer is **D** because when damping is decreased maximum amplitude increases and the frequency at which it occurs increases A is not correct because it states that they both decrease B is not correct because it states that the maximum amplitude decreases C is not correct because it states that the frequency decreases	1

Q2.

Question Number	Acceptable answers	Additional guidance	Mark
	A		1

Q3.

Question Number	Acceptable answer	Additional guidance	Mark
	D	The only correct answer is **D** because the frequency is inversely proportional to the square root of length and independent of the mass, so if length is quadrupled, frequency is halved to $f/2$ A is not the correct answer because it is $4f$ B is not the correct answer because it is $2f$ C is not the correct answer because it is f	1

Q4.

Question Number	Answer	Mark
	B – 0.40 Hz	1
	Incorrect Answers: Correct method: $f = 24 \div 60\ s = 0.40$ Hz A – uses 1 minute ÷ 24 C – uses 60 s ÷ 24 D – uses 24 ÷ 1 minute	

Q5.

Question Number	Answer	Additional guidance	Mark
	B		**(1)**

Q6.

Question Number	Answer	Additional guidance	Mark
	A	$(\frac{f}{\sqrt{2}})$	**(1)**

Q7.

Question Number	Acceptable answer	Additional guidance	Mark
	D	The only correct answer is **D**: velocity is maximum when displacement is zero, and vice versa, and has positive and negative values since the direction reverses A is not correct because this shows maximum velocity when it should be minimum and vice versa B is not correct because this shows maximum velocity when it should be minimum and vice versa C is not correct because this does not show the change in direction of velocity during an oscillation	1

Q8.

Question Number	Answer	Mark
	C	1

Q9.

Question Number	Answer	Mark
	The only correct answer is B because acceleration is proportional to force, so the acceleration graph would have the shape of the force graph. The acceleration at the start is zero, so the velocity graph must have an initial gradient of zero. For the acceleration to be positive in the first quarter cycle the velocity must be increasing. This graph has an initial gradient of zero and increasing velocity. A the initial gradient is not zero C the initial gradient is not zero D the velocity in the first quarter cycle is decreasing	1

Q10.

Question Number	Acceptable answers	Additional guidance	Mark
	The only correct answer is **D** because velocity is equal to the gradient of the displacement-time graph A is not correct because velocity is equal to the gradient of the displacement-time graph, but here velocity is shown as proportional to −1 times the displacement B is not correct because velocity is equal to the gradient of the displacement-time graph, but here velocity is shown as −1 times the gradient C is not correct because velocity is equal to the gradient of the displacement-time graph, but here velocity is shown as proportional to the displacement		1