BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

Skills 1

Sketch the following functions on the given domain and hence find their ranges:

(a) $f(x) = x^2 + 4x + 3$ Domain f: $x \in \mathbb{R}$

(b) $g(t) = 2t^2 - 4t - 1$ Domain g: $t \in \mathbb{R}$

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

Skills 2

The functions f and g are defined on the whole of R by $f(x) = x^2 + 1$, $g(x) = x + 3$

Find:

(a) $fg(0)$ (b) $fg(1)$ (c) $f^2(2)$ (d) $fg(x)$

(e) $gf(x)$ (f) $ff(x)$

TAP FOR ANSWERS

Skills 1 - Answers

(a) Range f: $f(x) \geq -1$

(b) Range g: $g(x) \geq -3$

TAP TO RETURN

Skills 2 – Answers

(a) 10

(b) 17

(c) 26

(d) $(x+3)^2+1$

(e) x^2+4

(f) $(x^2+1)^2+1$

TAP TO RETURN

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

1

A person throws a ball in a sports hall. The height of the ball, h m, can be modelled in relation to the horizontal distance from the point it was thrown from by the quadratic equation: $h = -\frac{3}{10}x^2 + \frac{5}{2}x + \frac{3}{2}$

The hall has a sloping ceiling which can be modelled with equation $h = \frac{15}{2} - \frac{1}{5}x$.

Determine whether the model predicts that the ball will hit the ceiling.

TAP FOR ANSWERS

2

The circle C has equation $x^2 + y^2 - 12x + 8y + 16 = 0$

(a) Find the centre and radius of C

(b) Given that C crosses the x axis at the points A and B, find the length AB giving your answer in the form $k\sqrt{5}$

TAP FOR ANSWERS

3

A car accelerates at a constant rate, starting from rest at a point A and reaching a speed of 65 km s^{-1} 26 s. This speed is then maintained and the car passes a point B 3 minutes after leaving A.

(a) Sketch a speed-time graph to illustrate the motion of the car.

(b) Find the distance from A to B.

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

4

Draw a force diagram and resolve forces horizontally and vertically. N.B. In the case o limiting friction, $F = \mu R$, where R is the normal reaction.

An airline passenger pushes a 15kg suitcase along the floor with his foot. A force (P) of 60N is needed to move the suitcase. Find:-

(a) the co-efficient of friction.

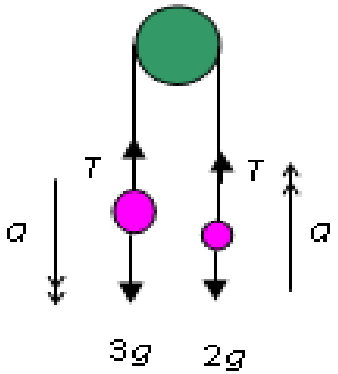
(b) the force needed to give the suitcase an acceleration of $0.2ms^{-2}$.

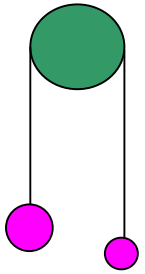
TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

5

Two masses of 3kg and 5kg are suspended either end of a light inextensible string which passes over a smooth fixed peg. The particles are held in the positions shown, with the string taut; they are then released from rest. Construct separate equations for each of the masses. Find the tension in the string and the acceleration of the particles.





TAP FOR ANSWERS

6

[In this question, the horizontal unit vectors **i** and **j** are directed due East and North respectively.]

A coastguard station *O* monitors the movements of ships in a channel. At noon, the station's radar records two ships moving with constant speed. Ship *A* is at the point with position vector $(-5\mathbf{i} + 10\mathbf{j})$ km relative to *O* and has velocity $(2\mathbf{i} + 2\mathbf{j})$ km h^{-1}. Ship *B* is at the point with position vector $(3\mathbf{i} + 4\mathbf{j})$ km and has velocity $(-2\mathbf{i} + 5\mathbf{j})$ km h^{-1}.

(a) Given that the two ships maintain these velocities, show that they collide.
The coast guard radios ship *A* and orders it to reduce its speed to move with velocity $(\mathbf{i} + \mathbf{j})$ km h^{-1}.

Given that *A* obeys this order and maintains this new constant velocity,

(b) find an expression for the vector $\overrightarrow{AB}$ at time t hours after noon.
(c) find, to 3 significant figures, the distance between A and B at 1400 hours,
(d) find the time at which *B* will be due north of *A*.

TAP FOR ANSWERS

7

A large tank is in the shape of a cuboid with a rectangular base and no top. Two of the vertical opposite faces of the cuboid are square and the height of the cuboid is x metres.

(a) given that the surface area of the tank is 54 m^2, show that the capacity, V, of the tank is given by $V = 18x - \frac{2}{3}x^3$.

(b) Find the maximum value for V, fully justifying the fact that it is the maximum value.

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

8

NEW TECHS!

$f(x) = \frac{5x^2+7x}{2x^4}$

(a) Split f(x) into two fractions and find an expression for f'(x)

(b) Now consider the functions $g(x) = 5x^2 + 7x \ \ and \ h(x) = 2x^4$. Find expressions for g'(x) and h'(x)

(c) Now, $f(x) = \frac{g(x)}{h(x)}$ Which one of the following rules is true?

A $f(x) = \frac{g\prime(x)}{h\prime(x)}$

B $f(x) = \frac{g'(x)h(x)+g(x)h\prime(x)}{h(x)}$

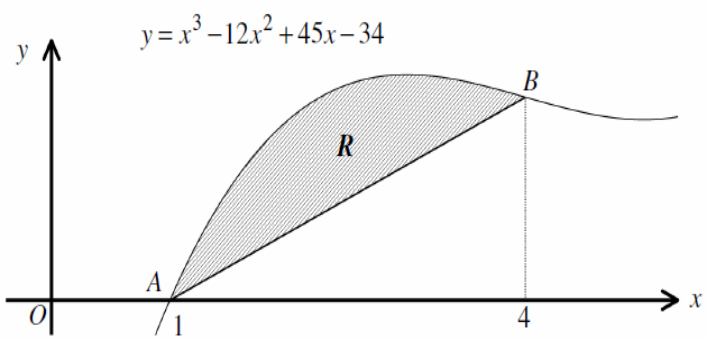
C $f(x) = \frac{g'(x)h(x)-g(x)h\prime(x)}{h(x)^2}$

D $f(x) = \frac{g'(x)h(x)+g(x)h\prime(x)}{h(x)^2}$

E $f(x) = \frac{g(x)h'(x)-g\prime(x)h(x)}{h(x)}$

TAP FOR ANSWERS

9



The figure above shows the curve with equation

$$y = x^3 - 12x^2 + 45x - 34$$

The points A and B lie on the curve, where $x = 1$ and $x = 4$ respectively. The finite region R is bounded by the curve and the straight line segment AB. Show that the area of R, shown shaded in the figure is $\frac{81}{4}$

TAP FOR ANSWERS

10

Evaluate the following

$$\lim_{\delta x \to 0} \sum_{x=0}^{36} (2 + \sqrt{x})^2 \, dx$$

TAP FOR ANSWERS

11

The function t is defined by t: $x \mapsto 5 - 2x$

Solve the equation $t^2(x) - \big(t(x)\big)^2 = 0$

TAP FOR ANSWERS

12

The function h is defined by $h(x) = x^2 - 6x + 20$ and has domain $x \geq a$. Given that $h(x)$ is a one-to-one function find the smallest possible value of the constant a.

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

You have a tracking test the week after you get back from Christmas. We have given you 4 less questions than normal here – use this time to revise anything you feel is weak to prepare for the test.

TAP FOR ANSWERS

1 - Answers

Yes, the ball will hit the ceiling.

TAP TO RETURN

2 - Answers

(a) Centre (6, -4) radius 6

(b) $k = 4$

TAP TO RETURN

3 - Answers

(b) 10855 km

TAP TO RETURN

4 - Answers

(a) $\mu=0.408$

(b) $P=63N$

TAP TO RETURN

5 - Answers

(a) $1.96\ ms^{-2}$

(b) T=23.5N

TAP TO RETURN

6 - Answers

(b) $AB = (8 - 3t)\mathbf{i} + (-6 + 4t)\mathbf{j}$

(c) 2.83 km

(d) 1440 hours

TAP TO RETURN

7 - Answers

(b) 36

TAP TO RETURN

8 - Answers

(a) $-\frac{5}{x^3}-\frac{21}{2x^4}$

(b) 10x + 7, $8x^3$

(c) C

TAP TO RETURN

9 - Answers

Proof

TAP TO RETURN

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 12B

10 - Answers

1368

TAP TO RETURN

11 - Answers

$3 \pm \frac{\sqrt{6}}{2}$

TAP TO RETURN

12 - Answers

$a = 11$

TAP TO RETURN