BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 17B

Skills 1

Find any point(s) of inflection of the following functions.

(a) $f(x) = \cos^2 x - 2\sin x, 0 < x < 2\pi$

(b) $f(x) = -\frac{x^3-2x^2+x-1}{x-2}, x \neq 2$

(c) $f(x) = -\frac{x^3}{x^2-4}, x \neq \pm 2$

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Skills 2

Now, Integrate the following functions using an appropriate method when required:

(a) $\int$ -sin(3x +1) dx

(b) $\int 4\cos\left(\frac{x}{2}\right)$ dx

(c) $\int$ tanx dx

(d) $\int$ cot4x dx

(e) $\int \sec^5 2x\, tan2x$ dx

(f) $\int$ tan5x dx

(g) $\int \sin^2 6x$ dx

(h) $\int 3\cos^2 2x$ dx

(i) $\int 3\tan^2 4x$ dx

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Skills 1 - Answers

(a) $\left(\frac{\pi}{6}, -\frac{1}{4}\right), \left(\frac{5\pi}{6}, -\frac{1}{4}\right)$

(b) (1, -1)

(c) (0, 0)

TAP TO RETURN

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Skills 2 – Answers

(a) $\frac{1}{3}\cos(3x+1)+c$

(b) $8\sin\left(\frac{x}{2}\right)+c$

(c) $-\ln(cosx)+c$

(d) $\frac{1}{4}\ln(sin4x)+c$

(e) $\frac{1}{10}\sec^5 2x+c$

(f) $-\frac{1}{5}\ln(cos5x)+c$

(g) $\frac{1}{2}x-\frac{1}{24}sin12x+c$

(h) $\frac{3}{2}x+\frac{3}{8}sin4x+c$

(i) $\frac{3}{4}tan4x-3x+c$

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1

The curve C has equation $y = xe^x$.

(a) Find the exact coordinates of the stationary point on C and determine its nature.

(b) Find the coordinates of any non-stationary points of inflection on C.

(c) Hence sketch the graph of $y = xe^x$

TAP FOR ANSWERS

2

(a) Sketch the two inequalities $y < 9 - x^2$ *and* $y \geq x^2 - 3x + 4$

(b) Shade the region that satisfies both inequalities

TAP FOR ANSWERS

BHASVIC MαTHS
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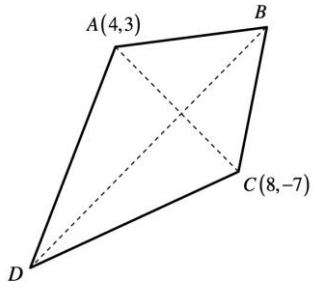
3



The figure shows a kite ABCD where the vertices A and C have coordinates (4,3) and (8,-7) respectively.
The diagonal BD is a line of symmetry of the kite.
Find an equation for the diagonal BD

TAP FOR ANSWERS

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4

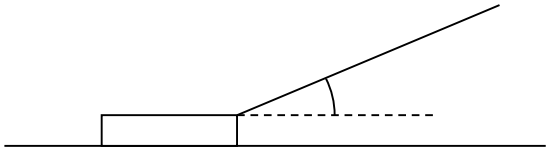
(a) A particle is projected upwards with a speed of 14 m s^{-1}. Find for how long it is above 2 m.

(b) A ball is thrown vertically upwards from a height 1.6m above the ground, with a speed of 7 m s^{-1}. Find the speed when it hits the ground.

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 17B

5



A sledge has mass 30 kg. The sledge is pulled in a straight line along horizontal ground by means of a rope. The rope makes an angle 20° with the horizontal, as shown in Figure 3. The coefficient of friction between the sledge and the ground is 0.2. The sledge is modelled as a particle and the rope as a light inextensible string. The tension in the rope is 150 N. Find, to 3 significant figures,

(a) the normal reaction of the ground on the sledge,

(b) the acceleration of the sledge

When the sledge is moving at 12 m s^{-1}, the rope is released from the sledge.

(c) Find, to 3 significant figures, the distance travelled by the sledge from the moment when the rope is released to the moment when the sledge comes to rest.

TAP FOR ANSWERS

6

NEW TECHNIQUES!

Given that the displacement s for a particle at time t seconds moving in a straight line is given by $s = t^3 + 4t + 6$

Where v is the velocity in ms^{-1} and a is the acceleration in ms^{-2} and given that $v = \frac{ds}{dt}$ and $a = \frac{d^2s}{dt^2}$. Find:

expressions for v and a terms of t,
the displacement, velocity and acceleration when t=2.

Only zero and positive values of t should be considered.

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 17B

7

Two helicopters P and Q are moving in the same horizontal plane. They are modelled as particles moving in straight lines with constant speeds. At noon P is at the point with position vector $(20\mathbf{i} + 35\mathbf{j})$ km with respect to a fixed origin O. At time t hours after noon the position vector of P is $\mathbf{p}$ km. When $t = \frac{1}{2}$ the position vector of P is $(50\mathbf{i} - 25\mathbf{j})$ km. Find

(a) the velocity of P in the form $(a\mathbf{i} + b\mathbf{j})$ km h^{-1},

(b) an expression for $\mathbf{p}$ in terms of t.

At noon Q is at O and at time t hours after noon the position vector of Q is $\mathbf{q}$ km. The velocity of Q has magnitude 120 km h^{-1} in the direction of $4\mathbf{i} - 3\mathbf{j}$. Find

(c) an expression for $\mathbf{q}$ in terms of t,

(*d*) the distance, to the nearest km, between P and Q when $t = 2$.

TAP FOR ANSWERS

BHASVIC MαTHS
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8

A curve C has equation $y = \frac{1}{2}e^{2x} - 4x + 1, \quad x \epsilon R$
The point P lies on C where x = ln 4.

(a) Show that the equation of the tangent to the curve is y = 12x +9 – 32 ln2

The point Q lies on C where x = ln 2.
The normal to the curve at the point Q meets the tangent to the curve at the point P, at the point R.

(b) Show that the co-ordinates of R are (ln2, 9 – 20ln2)

TAP FOR ANSWERS

9

The radius, r cm, of a circle is increasing at the constant rate of 3 $cm\ s^{-1}$
Find the rate at which the area of the circle is increasing when its radius is 13.5 cm.

TAP FOR ANSWERS

10

A circle has parametric equations $x = 4\sin t - 3, \quad y = 4\cos t + 5.$

(a) Find the Cartesian equation of the circle

(b) Draw a sketch of the circle

(c) Find the exact coordinates of the points of intersection of the circle with the y axis

TAP FOR ANSWERS

11

(a) Show that $\cos^4 x \equiv \frac{1}{8}\cos 4x + \frac{1}{2}\cos 2x + \frac{3}{8}$

(b) Hence find $\int \cos^4 x \, dx$

TAP FOR ANSWERS

12

(a) Given $f(x) = \frac{x}{x+3} - \frac{x+24}{2x^2+5x-3}$, show that $f(x) = \frac{2(x-4)}{2x-1}$

(b) Find $f^{-1}(x)$

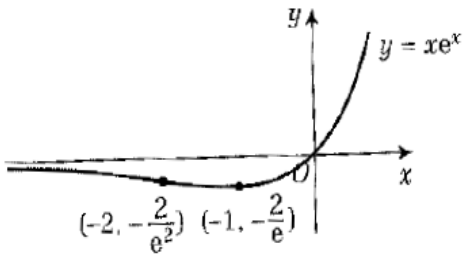
TAP FOR ANSWERS

1 - Answers

(a) $\left(-1, -\frac{1}{e}\right)$, minimum

(b) $\left(-2, -\frac{2}{e^2}\right)$

(c)



TAP TO RETURN

BHASVIC MαTHS
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2 - Answers

Sketch

TAP TO RETURN

3 - Answers

$5y = 2x - 22$

TAP TO RETURN

4 - Answers

(a) 2.56 seconds

(b) $9.0ms^{-1}$

TAP TO RETURN

5 - Answers

(a) 243N

(b) $3.08 ms^{-2}$

(c) 36.7m

TAP TO RETURN

6 - Answers

(a) $v=3t^2+4$, $a=6t$

(b) 22m, $16m^{-1}$,$12ms^{-2}$

TAP TO RETURN

7 - Answers

(a) 60**i** - 120**j**

(b) **p** = 20**i** + 35**j** + (60**i** - *120***j**)t

(c) **q** = 96t**i** - 72*t***j**

(d) 80 km

TAP TO RETURN

8 - Answers

Proof

TAP TO RETURN

9 - Answers

$81\pi\ cm^2 s^{-1}$

TAP TO RETURN

10 - Answers

(a) $(x+3)^2+(y-5)^2=16$

(b) check desmos

(c) $(0,5+\sqrt{7}),(0,5-\sqrt{7})$

TAP TO RETURN

BHASVIC MαTHS
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11 - Answers

(a) $\cos^4 x = (\cos^2 x)^2 = \left(\frac{1+\cos 2x}{2}\right)^2 = \frac{1}{4} + \frac{1}{2}\cos 2x$
$+ \frac{1}{4}\cos^2 2x = \frac{1}{4} + \frac{1}{2}\cos 2x + \frac{1}{4}\left(\frac{1+\cos 4x}{2}\right)$
$= \frac{3}{8} + \frac{1}{2}\cos 2x + \frac{1}{8}\cos 4x$

(b) $\frac{1}{32}\sin 4x + \frac{1}{4}\sin 2x + \frac{3}{8}x + c$

TAP TO RETURN

12 - Answers

(a) Proof

(b) $\frac{(x-8)}{2x-2}$

TAP TO RETURN