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# Vector mechanics for engineers statics and dynamics 10th edition solutions

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Answer: (c) www.elsolucionario.netwww.elsolucionario.netPROPRIETARY MATERIAL. 2013 The McGraw-Hill Companies, Inc. All rights reserved. No part of this Manual may be displayed, reproduced or distributed in any form or by any means, without the limited distribution to teachers and educators permitted by McGraw-Hill for their individual course preparation. If you are a student using this Manual, you are using it without permission. 4 PROBLEM 11CQ2 Two cars A and B race each other down a straight road. The position of each car as a function of time is shown. Which of the following statements are true (more than one answer can be correct)? (a) At time t2 both cars have traveled the same distance (b) At time t1 both cars have the same speed (c) Both cars have the same speed at some time t < t1 (d) Both cars have the same acceleration at some time t < t1 (e) Both cars have the same acceleration at some time t1 < t < t2 SOLUTION The speed is the slope of the curve, so answer (c) is true. The acceleration is the second derivative of the position. Since As position increases linearly the second derivative will always be zero. The second derivative of curve B is zero at the point of inflection which occurs between t1 and t2. Answers: (c) and (e) www.elsolucionario.netwww.elsolucionario.netPROPRIETARY MATERIAL. 2013 The McGraw-Hill Companies, Inc. All rights reserved. No part of this Manual may be displayed, reproduced or distributed in any form or by any means, without the prior written permission of the publisher, or used beyond the limited distribution to teachers and educators permitted by McGraw-Hill for their individual course preparation. If you are a student using this Manual, you are using it without permission. 5 PROBLEM 11.1 The motion of a particle is defined by the relation 4 210 8 12x t t t = + + , where x and t are expressed in inches and seconds, respectively. Determine the position, the velocity, and the acceleration of the particle when t = 1 s. SOLUTION 4 210 8 12x t t t = + + x t dtAt 1s,t = 1 10 8 12 11x = + + = 11.00 in.=x 4 20 8 8 = + + v 8.00 in./sv = 12 20 8 = + a 28.00 in./sa = www.elsolucionario.netwww.elsolucionario.netPROPRIETARY MATERIAL. 2013 The McGraw-Hill Companies, Inc. All rights reserved. No part of this Manual may be displayed, reproduced or distributed in any form or by any means, without the prior written permission of the publisher, or used beyond the limited distribution to teachers and educators permitted by McGraw-Hill for their individual course preparation. If you are a student using this Manual, you are using it without permission. 6 PROBLEM 11.2 The motion of a particle is defined by the relation 3 22 9 12 10, = + x t t where x and t are expressed in feet and seconds, respectively. Determine the time, the position, and the acceleration of the particle when v = 0. SOLUTION 3 22 9 12 10x t t t = + + Differentiating, 2 26 18 12 6( 3 2)6( 2) 1) = + + = + dxv t t t dt 12 18 = = dva tdtSo 0=v at 1 s=t and 2 s.=t At 1s,t = 1 2 9 12 10 15 = + + =x 1.000 st = 1 12 18 6 = = a 1 15.00 ft=x 21 6.00 ft/s= a At 2 s,=t 3 22(2) 9(2) 12(2) 10 14 = + + x 2.00 s=t 2 14.00 R=x 2 12(2) 18 6a = = 22 6.00 R/s=a www.elsolucionario.netwww.elsolucionario.netPROPRIETARY MATERIAL. 2013 The McGraw-Hill Companies, Inc. All rights reserved. No part of this Manual may be displayed, reproduced or distributed in any form or by any means, without the prior written permission of the publisher, or used beyond the limited distribution to teachers and educators permitted by McGraw-Hill for their individual course preparation. If you are a student using this Manual, you are using it without permission. 7 PROBLEM 11.3 The vertical motion of mass A is defined by the relation 10 sin 2 15cos2 100.x t t = + + where x and t are expressed in mm and seconds, respectively. Determine (a) the position, velocity and acceleration of A when t = 1 s, (b) the maximum velocity and acceleration of A. SOLUTION 10sin 2 15cos 2 100x t t = + + x t dt 40sin 2 30sin 2 = = dva t dtFor trigonometric functions set calculator to radians: (a) At 1s,=t 1 10sin 2 15cos(2.1588) 30sin(2.1588)36.056v = = max 36.1 mm/sv = Note that we could have also used 2 2max 20 30 36.056v = + = by combining the sine and cosine terms. For amax we can take the derivative and set equal to zero or just combine the sine and cosine terms. 2 2 2max 40 60 72.1 mm/sa = + = 2max 72.1 mm/sa = so www.elsolucionario.netwww.elsolucionario.netPROPRIETARY MATERIAL. 2013 The McGraw-Hill Companies, Inc. All rights reserved. No part of this Manual may be displayed, reproduced or distributed in any form or by any means, without the prior written permission of the publisher, or used beyond the limited distribution to teachers and educators permitted by McGraw-Hill for their individual course preparation. If you are a student using this Manual, you are using it without permission. 8 PROBLEM 11.4 A loaded railroad car is rolling at a constant velocity when it couples with a spring and dashpot bumper system. After the coupling, the motion of the car is defined by the relation 4 860 sin16t x e t = where x and t are expressed in mm and seconds, respectively. Determine the position, the velocity and the acceleration of the railroad car when (a) t = 0, (b) t = 0.3 s. SOLUTION 4 860 sin16t x e t = -4.8 4.84.8 4.860( 4.8) sin16 60(16) cos16288 sin16 960 cos16t tt tdxv e t e tdtv e t e t = = + = +4.8 4.84.8 4.84.81382.4 sin16 4608 cos164608 cos16 15360 sin1613977.6 sin16 9216 cos16t tt ttdva e t e tdt e t a e t e t = = = (a) At 0,t = 0 0x = 0 0 mmx = 0 960 mm/sv = 0 960 mm/sv = 20 9216 mm/sa = 20 9220 mm/sa = (b) At 0.3 s,t = 4.8 1.44 0.23692sin16 sin 4.8 0.9961cos16 cos 4.8 0.08750te etl = = = = = 0.3 (60)(0.23692)( 0.99616) 14.16x = = -0.3 14.16 mmx = 0.3 (288) (0.23692) 0.99616(960)(0.23692)(0.08750) 87.9v = + = 0.3 87.9 mm/sv = 0.3 (13977.6)(0.23692) 0.99616(9216)(0.23692)(0.08750) 3108a = = 20.3 3110 mm/sa = or 23.11 m/s www.elsolucionario.netwww.elsolucionario.netPROPRIETARY MATERIAL. 2013 The McGraw-Hill Companies, Inc. All rights reserved. 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